MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE.

VOL. XXIX. JULY, 1901. No. 7

INTRODUCTION.

The MONTHLY WEATHER REVIEW for July, 1901, is based on reports from about 3,100 stations furnished by employees and voluntary observers, classified as follows: regular stations of the Weather Bureau, 159; West Indian service stations, 13; special river stations, 132; special rainfall stations, 48; voluntary observers of the Weather Bureau, 2,562; Army post hospital reports, 18; United States Life-Saving Service, 9; Southern Pacific Railway Company, 96; Hawaiian Government Survey, 200; Canadian Meteorological Service, 32; Jamaica Weather Office, 160; Mexican Telegraph Service, 20; Mexican voluntary stations, 7; Mexican Telegraph Company, 3; Costa Rica Service, 7. International simultaneous observations are received from a few stations and used, together with trustworthy newspaper extracts and special reports.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. Curtis J. Lyons, Meteorologist to the Hawaiian Government Survey, Honolulu; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Camilo A. Gonzales, Director-General of Mexican Telegraphs; Mr. Maxwell Hall, Government Meteorologist, Kingston, Jamaica; Capt. S. I. Kimball, Superintendent of the United States Life-Saving Service; Commander Chapman C. Todd, Hydrographer, United States Navy; H. Pittier, Director of the Physico-Geographic Institute, San Jose, Costa Rica; Captain François S. Chaves, Director of the Meteorological Observatory, Ponta Delgada, St. Michaels, Azores, and W. M. Shaw, Esq., Secretary, Meteorological Office, London; Rev. Josef Algué, S. J., Director, Phillipine Weather Service.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the REVIEW, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to conform generally to the modern international system of standard meridians, one hour apart, beginning with Greenwich. The Hawaiian standard meridian is 157° 30′, or $10^h\ 30^m$ west of Greenwich. The Costa Rican standard of time is that of San Jose, $0^h\ 36^m\ 13^s$ slower than seventy-fifth meridian time, corresponding to $5^h\ 36^m$ west of Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are sometimes corrected to agree with the eastern standard; otherwise, the local standard is mentioned.

Barometric pressures, whether "station pressures" or "sea-level pressures," are now always reduced to standard gravity, so that they express pressure in a standard system of absolute measures.

FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

In accordance with the general directions of the Secretary of Agriculture, the following forecast districts were established July 1, 1901:

Boston center.—All of the New England States.

Chicago center.—Illinois, Indiana, Michigan, Wisconsin, Minnesota, Iowa, Missouri, Kansas, Nebraska, South Dakota, North Dakota, and Montana.

Denver center.—Colorado, New Mexico, Arizona, Utah, and Wyoming.

San Francisco center.—California and Nevada.

Portland, Oreg., center.—Washington, Oregon, and Idaho.

Galveston center.—Texas, Oklahoma, and Indian Territory, and advisory warnings for Mexico, and charge of the cooperation between the Mexican Weather Service and the United States Weather Bureau.

Washington center.—All States not included in the foregoing districts.

The instructions provide that the official in charge of each forecast center shall issue morning forecasts, cold wave, frost, and other warnings, except hurricane and emergency warnings, and all storm warnings for his district, forwarding copies of the same immediately by telegraph to Washington, D. C. Night forecasts, synopses, and cold-wave warnings for all districts, except San Francisco, Cal., and Portland, Oreg., will be made at Washington. The officials in charge at San Francisco and Portland will make night forecasts and warnings for their respective districts.

Forecasts of the direction and force of the wind and the state of the weather along the transatlantic steamer routes from the American coast to the Banks of New Foundland were issued daily at 8 a. m. and 8 p. m. These forecasts covered the first three days out, of steamers bound east from United States ports, and the morning forecasts were published, together with forecasts of fog, in the weather maps issued at Boston, New York, Philadelphia, Baltimore, and Washington.

The principal meteorological feature of the month was the intense heat which prevailed in the States of the central valleys and the middle-west. The heated period began about June 20, and continued until July 26, and the records of maximum temperature were exceeded generally in the States of the middle and upper Mississippi and middle and lower Missouri valleys. During this period an absence of general rains resulted in drought conditions which caused great damage in the corn belt of the districts named. These conditions were covered in the daily forecasts and synopses and

in special forecasts, and the breaking up of the heat and drought during the closing days of July was indicated well in advance by the forecasts.

Two disturbances of tropical origin reached our southern coasts during the first decade of the month. The first of these appeared in the vicinity of Barbados on the 2d, passed thence north of west over the Caribbean Sea to the Yucatan Channel by the night of the 7th, and reached the Texas coast on the 10th. This disturbance had the character of a large shallow depression, rather than that of a well-defined hurricane. Reports show that high winds were encountered northwest of Barbados on the 2d, and that severe wind and rain storms occurred along the south coast of Haiti on the 4th. Rough weather was also reported off the south coast of Cuba during the 8th. Passing from the Yucatan Channel the center of disturbance reached the Texas coast on the 10th, where the earlier signs of its approach were of an alarming character. Beginning on the 9th, Texas coast interests were fully informed by the Weather Bureau relative to the advance of the disturbance over the Gulf, and on the 10th the Bureau was able to issue advices that allayed the fears of the people.

The second storm referred to appeared over the eastern Caribbean Sea on the 6th, passed on a northwest course south of Porto Rico on the 7th, causing a wind velocity of 56 miles an hour at San Juan, skirted the eastern Bahamas on the 8th and 9th, arrived off the North Carolina coast on the 10th, and acquired marked intensity during the night of the 10th, when a maximum velocity of 64 miles an hour was reported at Hatteras, N. C. After the morning of the 11th the storm diminished rapidly in energy. Timely and accurate advices were telegraphed all points in the West Indies and on our southern coasts which lay in the path of these disturbances.

The tracks of the disturbances referred to are shown in part on Chart II.

BOSTON FORECAST DISTRICT.

The weather of the month was without unusual features, excepting, perhaps, the periods of high temperature. The changes to cool weather were correctly forecast, and the forecasts of rain were, as a rule, timely and successful.—*J. W. Smith, Forecast Official.*

CHICAGO FORECAST DISTRICT.

The month was remarkable on account of the intense thermal conditions and extraordinary drought which overspread the greater portion of the great central valleys of the Southwest for three consecutive weeks or more. Temperatures of 100° or over were recorded nearly every day from the 1st to the 25th in the central Mississippi and central and lower Missouri valleys. The maximum temperature records for July, and in fact for all months, were broken in nearly all the middle-west and southwest States. Maximum temperatures of 104° to 108° were recorded several times in the States of Iowa, Illinois, Missouri, and Kansas.

From the 6th to the 26th, inclusive, no rain, other than a few local showers on the 16th and 18th, occurred in central and southern portions of Illinois, Iowa, Missouri, Kansas, Nebraska, and South Dakota, practically covering the greater portion of the important corn-growing section. From the 27th to the 30th, inclusive, the drought was broken by more or less copious and general showers.—*F. J. Walz, Local Forecast Official.*

GALVESTON FORECAST DISTRICT.

But one important disturbance occurred during the month. On the 9th the morning weather map showed a disturbance over the lower Rio Grande Valley. The evening report of the 9th showed a storm of considerable intensity in the north of Mexico, off the mouth of the Rio Grande River. In the morning general forecast attention was called to the disturbance, and in the evening storm warnings were issued to all stations along the Texas coast. The tide rose rapidly and caused much uneasiness. The conditions were watched closely, and at 3:30 a. m. of the 10th the following bulletin was given to the press:

> The barometer is 29.78. The wind is 34 miles from the east, with occasional shifts to southeast. The east wind for the last two days has banked up the water and the tide is running quite high, but no swells are breaking in over the beach. The water is up to Avenue O at Twenty-fifth street. I believe that 2 feet additional rise will put the water across the island at Twenty-fifth street. This will depend a great deal on the force and direction of the wind during the next twelve hours. A flood of a serious nature is not yet indicated, although small buildings near the beach may be washed over. This matter will be watched closely by the Weather Bureau. If any serious change developes, the people will be fully advised.

At 9:30 a. m. the following information was given out:

> Tide has receded 3 feet and is now stationary.

At 3 p. m. the following bulletin was issued:

> Conditions less threatening; tide 2.5 feet and falling; disturbance apparently moving north to the west of Galveston.

These bulletins, which were given out through the press and over the telephone, allayed the fears of the people and proved very valuable.—*I. M. Cline, Forecast Official.*

DENVER FORECAST DISTRICT.

The low areas, generally ill defined, were a prominent feature of the pressure distribution, and, as the few high areas that appeared in the district northwest were of slight intensity, the month in the northern half of the district was characterized by exceptionally high temperatures, and a marked deficiency of precipitation, though thunderstorms were frequent. At Denver the month was the dryest July and the warmest month in thirty years, the period covered by the records.

In the southern half of the district the weather was generally seasonable.—*F. H. Brandenberg, Forecast Official.*

SAN FRANCISCO FORECAST DISTRICT.

During July storms of the Sonora type may be expected to move along the Mexican boundary westward, recurving over southeastern California, and thence moving northeastward across Nevada and Utah into Wyoming. When there is reason to suppose that the so-called "permanent high" of the south Atlantic coast lies farther to the west than usual, the paths of the storm through Arizona and New Mexico are, as a rule, farther to the west. Early in the month this westerly shift of the Sonora storm tracts was anticipated, and the results seem to have justified the expectation. An area of high pressure over the North Pacific remained in possession during the greater part of the month, and was probably the determining factor in the weather of the Pacific slope.

There was little or no rain in California until the end of the month. There was also less of the summer afternoon fog along the central coast.—*Alexander G. McAdie, Forecast Official.*

PORTLAND, OREG., FORECAST DISTRICT.

The month was seasonable, except that it was a trifle cooler than usual, and on the morning of the 4th light frosts occurred in southeastern Idaho, which were successfully forecast twenty-four hours in advance. No high nor hot winds

prevailed, and the entire month was favorable for the filling and ripening of grain and the growth of late crops, such as corn, potatoes, hops, and fruit.—*Edward A. Beals, Forecast Official.*

HAVANA, CUBA, FORECAST DISTRICT.

The only important disturbance of the month in the West Indies advanced from the vicinity of Barbados to the Yucatan Channel from the 2d to the 7th. [It is believed that this is the storm which reached the Texas coast by the morning of the 9th, where it caused high winds and high tides, as noted in the Galveston Forecast District report.—E. B. G.]

On the 2d the Barbados light-ship *Flummense* encountered a gale 60 miles north-northwest of Barbados. On the 4th severe storms were reported on the southern coast of Haiti. Ample warnings of the character and course of this disturbance were sent to points in its line of advance. Daily wind forecasts for the Atlantic and Gulf of Mexico north of Cuba and east and west of Florida were telephoned the captain of the port.—*W. B. Stockman, Forecast Official.*

RIVERS AND FLOODS.

The Mississippi River below the mouth of the Missouri was somewhat higher than during June, and considerably higher than during July, 1900. Below the mouth of the Missouri it averaged from 3 to 7 feet lower, the loss below Cairo, Ill., being directly attributable to the rapid decline in the Ohio, which was decidedly lower than during June. The stages, however, were not sufficiently low to interfere with navigation, and did not materially differ from those of July, 1900.

The Missouri fell steadily throughout the month, though not to any great extent.

The rivers of the East presented nothing of special interest, except in the Carolinas where heavy rains from the 12th to the 20th, inclusive, caused rapid rises to near or slightly above the danger lines at many places. Timely warnings were issued wherever necessary, and no serious damage was reported.

On the 27th of the month the Arkansas River at Little Rock, Ark., fell to a stage of 1.1 feet, one foot lower than during any previous July, the record extending back to 1872, and was still lower at other places within the State.

The Brazos River was also lower, and there was a steady fall in the rivers of the Pacific coast system.

The highest and lowest water, mean stage, and monthly range at 135 river stations are given in Table VII. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are: Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport on the Red.—*H. C. Frankenfield, Forecast Official.*

AREAS OF HIGH AND LOW PRESSURE.

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocities.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
High areas.		°	°		°	°	*Miles.*	*Days.*	*Miles.*	*Miles.*
I	6, a. m.	41	101	9, p. m.	38	75	2,455	3.5	701	29.2
II	9, p. m.	48	104	13, p. m.	32	65	2,500	4.0	625	26.0
III	17, a. m.	50	100	20, p. m.	39	74	1,920	3.5	548	22.8
IV	22, a. m.	50	97	24, a. m.	38	80	1,200	2.0	600	25.0
V	23, a. m.	53	122	28, p. m.	45	67	3,680	5.5	669	27.9
VI	29, a. m.	50	111	*2, a. m.	37	86	1,900	4.0	475	19.8
Sums							13,655	22.5	3,618	150.7
Mean of 6 paths							2,276		603	25.1
Mean of 22.5 days									607	25.3
Low areas.										
I	1, p. m.	41	118	8, a. m.	46	60	4,150	6.5	638	26.6
II	5, a. m.	20	77	10, a. m.	29	95	1,200	5.0	240	10.0
III	6, a. m.	54	114	9, a. m.	45	93	1,800	3.0	600	25.0
IV	8, a. m.	22	70	10, a. m.	35	75	1,050	2.0	525	21.9
V	18, p. m.	50	110	23, a. m.	48	54	3,000	4.5	667	27.8
VI	24, a. m.	44	70	26, a. m.	35	75	700	2.0	350	14.6
VII	27, p. m.	39	108	31, a. m	48	68	2,400	3.5	686	28.6
Sums							14,300	26.5	3,706	154.5
Mean of 7 paths							2,043		529	22.1
Mean of 26.5 days									540	22.5

*August.

For graphic presentation of these highs and lows see Charts I and II.—*Geo. E. Hunt, Chief Clerk Forecast Division.*

CLIMATE AND CROP SERVICE.

By JAMES BERRY, Chief of Climate and Crop Service Division.

The following summaries relating to the general weather and crop conditions are furnished by the directors of the respective sections of the Climate and Crop Service of the Weather Bureau.

[Temperature is expressed in degrees Fahrenheit and precipitation in inches and hundredths.]

Alabama.—The mean temperature was 82.2°, or 2.1° above normal; the highest was 108°, at Bermuda on the 12th, and the lowest, 56°, at Maple Grove on the 9th and at Riverton on the 10th. The average precipitation was 3.40, or 1.54 below normal; the greatest monthly amount, 8.95, occurred at Mobile, and the least, 0.35, at Notasulga.

The month, as a whole, was generally unfavorable for growth of all crops, except cotton, which made satisfactory progress. Prolonged drought in some northern, north-central, and south-central counties, together with excessively hot, parching winds during middle of month seriously damaged corn and gardens. Rainfall somewhat excessive in extreme southern and extreme northeastern counties.—*F. P. Chaffee.*

Arizona.—The mean temperature was 85.5°, or 2.8° above normal; the highest was 123°, at Mohawk Summit on the 9th and at Maricopa on the 10th, and the lowest, 31°, at Fort Defiance on the 7th. The average precipitation was 2.04, or 0.64 above normal; the greatest monthly amount, 6.40, occurred at Pantano, and the least, trace, at a number of stations.

Light and widely scattered showers, high drying winds, with lack of water supply for irrigation purposes, during the first and second decades of the month seriously retarded plant growth, and farming operations were confined mostly to harvesting. A damaging frost occurred in the northeast section of the territory on the 7th, Fort Defiance reporting a minimum temperature of 31°. From the 20th to 31st general and beneficial rains occurred in all parts of the Territory, and the month closed with ranges greatly revived and irrigating canals running full.—*L. M. Dey, Jr.*

Arkansas.—The mean temperature was 83.7°, or 3.5° above normal; the highest was 116, at Jonesboro on the 12th, and the lowest, 50°, at Pond on the 10th. The average precipitation was 2.50, or 1.35 below normal; the greatest monthly amount, 7.55, occurred at Hot Springs (near), and the least, 0.10, at Arkansas City.

Showers fell in many sections, but were so light and scattered that very little benefit was derived. The temperature was excessively high during the greater portion of the month, and corn suffered greatly from the hot, dry weather; the first planted began to twist early in the month and the late planted was not doing well. Toward and during the last weeks of the month early planted corn had been so badly in-

jured that it was almost a total failure, while the late planted had been irreparably injured in some sections. Cotton stood the droughty conditions and heat fairly well during the early part of the month, but toward the close it had commenced to show the effects of the dry, hot weather; it had stopped growing, and had commenced to bloom on top and to shed its leaves and squares in many localities. Wheat thrashing had been completed and the yield was small, though better than had been anticipated. Harvesting of oats had been completed and by the end of the month thrashing was over; the yield was poor. Irish potatoes were rotting in the ground. Fruits of all kinds were scarce and had been damaged by the hot, dry weather.—*E. B. Richards.*

California.—The mean temperature was 76.0°, or 0.4° below normal; the highest was 121°, at Volcano on the 6th, 8th, 9th, 12th, 18th, and 19th, and the lowest, 28°, at Bodie on the 3d. The average precipitation was 0.01, or 0.04 below normal; the greatest monthly amount, 0.39, occurred at Bodie, while none fell at more than half of the stations.

Conditions during the month were generally very favorable for all crops. The usual high temperatures prevailed in the interior, causing rapid maturing of the fruit and grain crops, and along the coast the weather was warm and pleasant, with frequent fogs. Fires in the San Joaquin and Sacramento valleys destroyed many large fields of grain and pasturage. The month was practically free from northers.—*Alexander G. McAdie.*

Colorado.—The mean temperature was 71.6°, or 3.8° above normal; the highest was 108°, at Lamar on the 10th, and the lowest, 27°, at Wagon Wheel Gap on the 4th and Lay on the 5th. The average precipitation was 1.10, or 1.10 below normal; the greatest monthly amount, 3.71, occurred at Clear View, while none fell at Las Animas and only a trace at Fort Morgan.

Month was notably dry, with an exceptionally large number of hot days. Where water was available for irrigation, a majority of the crops made satisfactory progress. Excessive heat at a critical period caused a shrinkage in the yield of spring wheat, oats, and barley. Lack of moisture materially reduced yield of second cutting of alfalfa. At the beginning of the month water supply was generally adequate, but the volume diminished rapidly, and before its close late ditches were dry.—*F. H. Brandenburg.*

Cuba.—The mean temperature was 80.9°; the highest was 100°, at Nuevitas, Puerto Principe Province, on the 19th, and the lowest, 60°, at Los Canos, Santiago de Cuba Province, on the 25th. The average precipitation was 8.04; the greatest monthly amount, 13.97, occurred at Yaguajay, Santa Clara Province, and the least, 2.76, at Los Canos, Santiago de Cuba Province.

Seasonal rains occurred during the month, generally greatly benefiting growing crops, but interrupting or suspending field work, which, however, progressed at the end of the month in all sections, except in southeast Havana, on the lowlands of western Santa Clara, and in northeast Puerto Principe, where the soil was too wet to work. Rain was needed at the end of the month in southeast Santa Clara. Tobacco selecting progressed, except in northeast Pinar del Rio, where it was at a standstill. Canes generally were in a satisfactory to excellent condition. In southwest Santa Clara ratoons were beginning to show the ill effects of excessive moisture. Small crops were scarce in portions of southwest and northeast Pinar del Rio, southern Havana, northwest Matanzas, and northern Santa Clara.—*W. B. Stockman.*

Florida.—The mean temperature was 81.8°, or 0.3° above normal; the highest was 107°, at Wausau on the 12th, and the lowest, 64°, at Sumner on the 6th. The average precipitation was 6.67, or about normal; the greatest monthly amount, 13.35, occurred at Earnestville, and the least, 1.55, at Merritts Island.

The condition of cotton was not entirely satisfactory during the early part of the month. It was from two to three weeks late, fruited slowly and troubled somewhat with rust. The staple improved during the latter part of the month, and the early planted was opening on uplands. Grass caused some trouble in eastern counties. Corn, as a rule, did well; the crop ranges from fair to excellent. Cane, citrus fruits, and minor crops were quite satisfactory.—*A. J. Mitchell.*

Georgia.—The mean temperature was 81.5°, or 1.8° above normal; the highest was 106°, at Thomasville on the 12th, and the lowest, 53°, at Ramsey on the 9th. The average precipitation was 4.18, or 1.76 below normal; the greatest monthly amount, 13.56, occurred at Waverly, and the least, 0.88, at Woodbury.

The warmest July in the past ten years. The 11th and 12th were generally the warmest days. The precipitation was a variable element, portions of the State suffering from drought, while in others, particularly the southeastern counties, the rainfall was excessive, ranging from 8 to 13 inches. The general effect of the weather on crops was favorable, and a marked improvement was noted at the close of the month.—*J. B. Marbury.*

Idaho.—The mean temperature was 69.7°, or 1.7° above normal; the highest was 113°, at Garnet on the 6th and 30th, and the lowest, 18°, at Chesterfield on the 5th. The average precipitation was 0.28, or 0.17 below normal; the greatest monthly amount, 2.17, occurred at Priest River, while none fell at American Falls, Downey, Garnet, Idaho City, Ola, and Payette.

There has been no appreciable precipitation in southwestern Idaho since the 30th of May, but water for irrigation is sufficient in this section. In southeastern Idaho, where drought has been broken occasionally, there is great scarcity of water. There were no severe storms during the month.—*S. M. Blandford.*

Illinois.—The mean temperature was 82.3°, or 6.0° above normal; the highest was 115°, at Centralia on the 22d, and the lowest, 40°, at Chemung on the 8th. The average precipitation was 2.44, or 1.04 below normal; the greatest monthly amount, 8.98, occurred at Dixon, and the least, trace, at Danville.

Very hot, and in many localities very dry, weather during July caused serious damage to vegetation generally. Except in northern district, the corn crop will be very light. Pastures are badly dried up and much stock must be fed.—*M. E. Blystone.*

Indiana.—The mean temperature was 81.2°, or 5.2° above normal; the highest was 112°, at Salem on the 22d, and the lowest, 46°, at Cambridge on the 9th. The average precipitation was 1.30, or 2.08 below normal; the greatest monthly amount, 5.95, occurred at Angola, and the least, traces, at Greencastle and Scottsburg.

The heat during the month was unprecedented. The maximum temperatures rose to 90° and above on an average of twenty-five days; the temperature equaled or exceeded 100° on an average of five days; in the southwestern part of the State the maximum temperatures ranged from 100° to 112° on an average of fourteen days. The promising condition of all late crops was materially reduced by the intense heat and continued absence of rain as the month advanced. Early planted and upland corn, and that portion of the crop planted in clay and sandy soils, was practically beyond recovery as a result of the drought, and the late planted and lowland crops were badly in need of rain to assure the average yield. Wheat, rye, oats, and barley, had generally reached maturity before the effects of the drought were severely felt. Tobacco was badly needing rain, and tomatoes, potatoes, and gardens, were in poor condition. Much fruit was wilting on the trees, and apples continued falling; peaches were plentiful. A good hay crop was secured, but timothy was weedy.—*R. H. Sullivan.*

Iowa.—The mean temperature was 82.4°, or 8.7° above normal; the highest was 113°, at Sigourney on the 22d, and the lowest, 46°, at Maquoketa on the 8th. The average precipitation was 2.34, or 1.34 below normal; the greatest monthly amount, 5.97, occurred at Ridgeway, and the least, 0.22, at Denison.

July, 1901, broke all previous records in this State of maximum temperatures and great length of the period of extreme heat. The effect on crops and all forms of vegetation was very injurious, and the damage would have been greater than in the notable drought of 1894, but for the fact that the soil was generally better supplied with moisture at the outset, and the rainfall was much nearer the normal amount. Corn, pastures, potatoes, garden truck, and apples, suffered most heavily. The conditions were favorable for securing hay, wheat, oats, barley, and rye in fine order.—*John R. Sage.*

Kansas.—The mean temperature was 85.0°, or 7.0° above normal; the highest was 112°, at Phillipsburg on the 16th, and the lowest, 44°, at Coolidge on the 31st. The average precipitation was 1.94, or 2.16 below normal; the greatest monthly amount, 4.85, occurred at Rome, and the least, 0.15, at Abilene and Achilles.

Hot, dry month, highest mean for any month on State records; drought broken in eastern counties last week; early corn ruined, late held well but damaged some; pastures failed; hay crop light; gardens died; stock water scarce; fruits failing. In eastern counties, last week, pastures and meadows started anew, and late corn, peaches, and winter apples, began improving.—*T. B. Jennings.*

Kentucky.—The mean temperature was 81.7°, or 4.0° above normal; the highest was 112°, at Paducah on the 23d, and the lowest, 48°, at Centertown and Fords Ferry on the 8th and at Loretto on the 9th. The average precipitation was 1.72, or 2.67 below normal; the greatest monthly amount, 4.32, occurred at Williamsburg, and the least, 0.17, at Bowling Green.

Very warm weather prevailed throughout the month, the last decade being intensely hot. All previous records for heat were broken. Very little rain fell in the State from the 5th to 29th, and a severe drought resulted. Early corn and gardens were ruined, and all other crops suffered severely.—*H. B. Hersey.*

Louisiana.—The mean temperature was 83.0°, or 1.2° above normal; the highest was 111°, at Liberty Hill and Minden on the 13th, and the lowest, 55°, at Plain Dealing on the 9th. The average precipitation was 5.07, or 1.61 above normal; the greatest monthly amount, 15.83, occurred at Amite, and the least, 2.07, at Prevost.

During the first three weeks beneficial showers occurrrd in south portion, elsewhere rainfall was deficient; last week of month copious showers occurred generally throughout the State, improving all crops. Excessive heat prevailed throughout Louisiana from 12th to 18th; on the 13th and 14th maximum temperatures ranging from 98° to 111° obtained all over the State, breaking all previous records; latter part of month comparatively cool. Cane crop made good progress, some laid by in fine condition, and at close of month showed good color, had attained normal size, and looked promising. Cotton crop did fairly well, and in northern counties stood the drought better than expected; at close of month the stands were small, condition somewhat improved, and growing and fruiting well; some picking was done in southwest portion of cotton district. Rice, wherever irrigated, will

make a fine crop, and in some favored localities Providence rice was saved by timely showers. Old corn practically a failure; young corn will make a light crop.—*I. M. Cline.*

Maryland and Delaware.—The mean temperature was 78.8°, or 3.1° above normal; the highest was 106°, at Hancock, Md., on the 1st, and the lowest, 40°, at Sunnyside, Md., on the 7th. The average precipitation was 5.42, or 1.32 above normal; the greatest monthly amount, 10.81, occurred at Wyoming, Del., and the least, 2.11, at Westernport, Md.

The intense heat early in July caused many prostrations and deaths, but cooler weather on the 8th brought relief, and since then the hot spells have been endurable. The rainfall was ample, and in places excessive, except in the northeastern, southeastern, and extreme western districts, where the amounts were comparatively light. The general weather conditions of the month were favorable to growing crops, but frequent and heavy showers during the harvest period damaged wheat, rye, oats, and hay. These crops are below average in yield for the State, although good local returns are reported for all except oats, which are everywhere poor. Tobacco was hurt to some extent by heat and heavy rains, but improved later. Peaches are in fair promise, but other fruits will yield lightly. Early potatoes are not coming up to expectations, but late potatoes are more promising. Tomatoes have not fruited well in most districts. Gardens and other minor crops have fared satisfactorily.—*Oliver L. Fassig.*

Michigan.—The mean temperature was 72.8°, or 4.3° above normal; the highest was 108°, at Marquette on the 15th, and the lowest, 29°, at Humboldt on the 7th. The average precipitation was 4.20, or 1.22 above normal; the greatest monthly amount, 10.40, occurred at Iron River, and the least, 1.32, at Fennville.

The month has been characterized by high temperatures, and in many counties by heavy rainfall. Most crops have made good growth and hay, wheat, and rye were generally well secured. Hot and dry weather prevailed during the second decade, greatly shortening the berry and early potato crops. Corn, sugar beets, beans, and late potatoes have made fine progress during the month and are in a very promising condition. In the extreme southwestern portion of the Lower Peninsula the conditions have been droughty all the month, but the area is small. The conditions were unfavorable for oats, which matured on a short straw and were mostly harvested by close of month.—*C. F. Schneider.*

Minnesota.—The mean temperature was 74.7°, or 4.0° above normal; the highest was 110°, at New London on the 20th and 24th, and the lowest, 35°, at Tower on the 8th. The average precipitation was 3.33, or 0.29 below normal; the greatest monthly amount, 12.08, occurred at New Folden, and the least, 0.81, at Lynd, No. 2.

There was showery weather the first week of the month, and from the 24th to about the 28th. A period of excessively high temperatures lasted from the 13th to the 24th, with several mid-day temperatures higher than ever previously recorded in the State. The month opened with all the crops in an unusually promising condition, except those which were flooded on the lowlands of the Red River Valley early in the month, but the intense heat of the middle of the month brought on premature ripening of wheat and early oats in southern and central portions, with serious loss to yield and quality of wheat. In the northern counties the wheat does not seem to have been injured by the heat. The corn was benefited by the moisture and heat early in the heated term, but as the soil moisture was lost, corn deteriorated, so that by the end of the month the prospects for a good crop were much lessened. Rye, early barley, and winter wheat were being cut the first week in the month; early oat cutting began shortly before the 15th, and spring wheat on the 16th. A large hay crop was being saved in northern, central, and southwestern portions.—*T. S. Outram.*

Mississippi.—The mean temperature was 83.3°, or 2.2° above normal; the highest was 110°, at Windham on the 12th, and the lowest, 52°, at Aberdeen on the 7th. The average precipitation was 3.98, or 1.35 below normal; the greatest monthly amount, 11.43, occurred at Biloxi, and the least, 0.25, at Hernando.

The mean temperature for the month was the highest on record. The maximum temperature reached 100° or more at every station. Over the northern and middle portions of the State the average deficiency in rainfall was more than 2.00 inches, while over the southern portion the excess on the average exceeded 2.00 inches. Early corn was practically ruined by the dry weather of June and the first half of July; as a rule, late corn promised a fair crop. Cotton, although late and small, generally did well; at the close of the month it was growing rapidly and fruiting satisfactorily, except in the northern portion of the State, where its growth was retarded by blooming to the top. Owing to the drought in many northern and central counties minor crops were poor, pastures dry, and stock water scarce, while in the southern counties rice, sugar cane, sweet potatoes, and melons generally did well.—*W. S. Belden.*

Missouri.—The mean temperature was 85.3°, or 8.4° above normal; the highest was 116°, at Marble Hill on the 22d, and the lowest, 46°, at Potosi on the 8th. The average precipitation was 2.03, or 2.46 below normal, the greatest monthly amount, 4.90, occurred at Shelbina, and the least, 0.05, at Mt. Vernon.

July, 1901, broke all records of high temperature in this State. The period of extreme heat began on June 20 and continued almost uninterruptedly until July 25, thirty-six days. The temperature was above 100° in some portion of the State every day from June 20 to July 31, and on July 12, 22, and 23 it reached 100° or above at all stations, maximum temperatures of 110° and above being recorded at many stations. At nearly all stations the mean temperature of July was from 3° to 9° higher than any July mean previously recorded. The drought, which began April 18, 1901, continued throughout the greater part of the State until July 25, and was greatly intensified by the extremely high temperature. Corn, which had already been damaged to a considerable extent at the beginning of the month, continued to deteriorate until at the close the larger portion was entirely beyond recovery and, on an average, hardly one-fourth of a crop was expected. Cotton also declined considerably and there was much complaint of shedding. The oat crop was one of the poorest ever harvested in the State, and flax was almost a complete failure. The hay crop was secured in good condition, but was extremely light. Pastures continue dry and short, and water became very scarce in many places. Apples and peaches were greatly damaged and gardens were almost completely dried up.—*A. E. Hackett.*

Montana.—The mean temperature was 69.1°, or 2.4° above normal; the highest was 112°, at Billings on the 31st, and the lowest, 28°, at Ovando on the 4th. The average precipitation was 1.02, or 0.14 below normal; the greatest monthly amount, 3.65, occurred at Glendive, while none fell at Corvallis.

The mean temperature for the month was above the normal over the east portion; in the central portion the record for the highest monthly mean temperature was broken at almost every station, and it was the coldest on record over the extreme northwest portion of the State. The stage of water in all streams is extremely low and in many localities there is not a sufficient supply for irrigation purposes.—*E. J. Glass.*

Nebraska.—The mean temperature was 82.0°, or 7.0° above normal; the highest was 111°, at Dawson on the 22d, and the lowest, 45°, at Camp Clark on the 5th. The average precipitation was 1.59, or 1.78 below normal; the greatest monthly amount, 7.19, occurred at Fairmont, while none fell at Wallace.

The excessively high temperature which prevailed from the 8th to the 27th, combined with the great deficiency in precipitation, was exceedingly unfavorable for all vegetation. Winter wheat ripened before the drought and was harvested in good condition. Berries and garden vegetables dried up almost completely. Oats and spring wheat were much damaged, but corn suffered the most seriously, being in the critical period of growth, the tassels were largely killed and the crop reduced to a small fraction of what it should have been.—*G. A. Loveland.*

Nevada.—The mean temperature was 70.8°, or about normal; the highest was 109°, at Halleck on the 30th, and the lowest, 31°, at Quinn River Ranch on the 1st. The average precipitation was 0.31, or 0.10 below normal; the greatest monthly amount, 1.19, occurred at Palmetto, while none fell at several stations.

The early part of the month was moderately cool, but the latter portion was very much warmer than usual. The precipitation was remarkably light all over the agricultural portion of the State. Irrigation water was plentiful, and all crops made rapid and satisfactory growth. Favorable weather prevailed for harvesting hay and grain.—*J. H. Smith.*

New England.—The mean temperature was 71.4°, or 2.6° above normal; the highest was 104°, at Provincetown, Mass., on the 4th, and the lowest, 36°, at Flagstaff, Me., on the 24th and 25th. The average precipitation was 4.24, or 0.43 below normal; the greatest monthly amount, 6.79, occurred at Plymouth, N. H., and the least, 0.91, at Eastport, Me.

The weather of the month was warm with well distributed showers, and the general conditions were favorable to crops and to farm operations. No general storm passed over the section; although thunderstorms were of frequent occurrence, which in a number of instances were destructive to property.—*J. W. Smith.*

New Jersey.—The mean temperature was 73.3°, or 3.3° above normal; the highest was 107°, at Somerville, Indian Mills, and Salem on the 2d, and the lowest, 41°, at Layton on the 20th. The average precipitation was 5.87, or 0.91 above normal; the greatest monthly amount, 10.92, occurred at Dover, and the least, 1.89, at Atlantic City.

A very warm, sultry month, with frequent, and in places, severe thunderstorms, doing considerable injury to the growing crops. Wheat, rye, and hay harvested. Hay all housed in fine order, but wheat and rye damaged by excessive rains. All truck crops promising, except potatoes and late tomatoes. Tree fruits, except peaches, will be a very short crop; grapes promising.—*E. W. McGann.*

New Mexico.—The mean temperature was 75.1°, or 1.1° above normal; the highest was 110°, at San Marcial on the 5th and 6th, and the lowest, 40°, at Blue Water on the 5th. The average precipitation was 2.75, or 0.22 below normal; the greatest monthly amount, 6.68, occurred at Lower Penasco, and the least, trace, at Olio.

All crops made satisfactory growth. Feed and water continued sufficient on stock ranges, and cattle and sheep were in very good condition.—*R. M. Hardinge.*

New York.—The mean temperature was 73.0°, or 4.1° above normal; the highest was 104°, at Primrose on the 2d, and the lowest, 34°, at Axton on the 26th. The average precipitation was 4.28, or 0.09 above

normal; the greatest monthly amount, 9.63, occurred at Primrose, and the least, 1.79, at Lyons.

The month was generally favorable for the harvest and for the growth of crops. The first few days were intensely hot, and high temperatures obtained during the week ending on the 22d, but on other dates more moderate temperatures were reported. While there were several short periods, during which the ground was too dry for favorable crop growth, the precipitation for July was generally sufficient to insure satisfactory crop conditions at the close of month.—*R. G. Allen.*

North Carolina.—The mean temperature was 78.8°, or 1.3° above normal; the highest was 105°, at Washington on the 25th, and the lowest, 49°, at Linville on the 10th. The average precipitation was 6.59, or 0.98 above normal; the greatest monthly amount, 13.23, occurred at Southern Pines, and the least, 1.23, at Murphy.

Considerable improvement in crops took place during the early and latter portions of the month in consequence of dry, warm weather, but the excessive precipitation from the 8th to the 20th was extremely injurious, causing rank growth, trouble with grass and weeds, damage to land by washing, and destruction of lowland crops by freshets. Fruit of all kinds rotted badly.—*C. F. von Herrmann.*

North Dakota.—The mean temperature was 70.8°, or 2.8° above normal; the highest was 110°, at Fort Yates on the 24th, and the lowest, 40°, at Ashley on the 28th. The average precipitation was 4.28, or 1.65 above normal; the greatest monthly amount, 8.14, occurred at Power, and the least, 1.13, at Fort Yates.

The mean temperature was higher than the average, with a few very warm days, when the highest maximum temperatures ever recorded were observed. While the total precipitation was considerably in excess of the normal amount, on the whole, the month was very favorable for crops of all kinds, and they made a very marked and vigorous growth.—*B. H. Bronson.*

Ohio.—The mean temperature was 78.1°, or 4.4° above normal; the highest was 109°, at Camp Dennison and Jacksonboro, on the 22d, and the lowest, 48°, at Lima and Orangeville on the 9th. The average precipitation was 2.73, or 1.25 below normal; the greatest monthly amount, 6.62, occurred at Plattsburg, and the least, 0.55, at Jacksonboro.

High temperatures prevailed during the greater part of the month, the mean for the State being the highest ever recorded. After the first week, in the southern and western districts, a drought set in which continued through the month, being most severe in the south. All crops and fruits have been seriously affected, excepting corn in the northern districts.—*J. Warren Smith.*

Oklahoma and Indian Territories.—The mean temperature was 85.9°, or 4.4° above normal; the highest was 116°, at Wagoner, Ind. T., on the 16th, and the lowest, 42°, at Kenton, Okla., on the 5th. The average precipitation was 1.92, or 1.58 below normal; the greatest monthly amount, 5.78, occurred at Holdenville, Ind. T., and the least, 0.02, at Oklahoma, Okla.

Intense heat, with an almost entire lack of precipitation during the forepart, and with light to heavy local showers during the latter part, characterized the month. Early corn was almost entirely ruined, while late corn was badly injured. Cotton, kaffir and broom corn, cane, and castor beans were in fair condition, but gardens and fruit were badly damaged. Pastures were revived by recent rains, stock water was scarce, and stock suffered for lack of water and feed. Wheat thrashing nearing completion.—*Charles M. Strong.*

Oregon.—The mean temperature was 64.8°, or 1.6° below normal; the highest was 108°, at Riverside on the 6th, and the lowest, 28°, at Beulah on the 4th. The average precipitation was 0.19, or 0.26 below normal; the greatest monthly amount, 2.68, occurred at Bay City, while none fell at several stations in eastern and southern portions.

The month was favorable for the ripening of grain and fruit. The harvesting of fall grain was in active progress at the close of the month. Haying was finished during the third week, and a large crop was housed in excellent condition.—*Edward A. Beals.*

Pennsylvania.—The mean temperature was 76.4°, or 4.9° above normal; the highest was 107°, at York on the 2d, and the lowest, 45°, at Emporium on the 7th. The average precipitation was 3.88, or 0.59 below normal; the greatest monthly amount, 7.34, occurred at Forks of Neshaminy, and the least, 1.52, at Harrisburg.

The first week was extremely hot throughout the State; on the 1st and 2d the temperature at many points reached an unprecedented height. From the 8th to 15th cooler and more seasonable weather prevailed, with frequent showers throughout all the State. The remainder of the month continued warm until the 26th, when a very perceptible fall in temperature occurred and the remainder of the week was cool, the mean temperatures being very generally below normal. With the exception of the 19th, 20th, and 21st rain fell on every day the balance of the month. At the close of the month rye cutting continued where showers did not interfere, and the consensus of opinion is that the yield will be generally good. Wheat, in many cases, is not turning out well; some thrashing has been done and a great deal of the crop has been found to be light in yield and the grain of an inferior quality. Haying continues, the crop still proving above an average one. Buckwheat looks well; more will be sown on a large number of farms as soon as the weather becomes favorable. Tobacco made considerable improvement and is very generally overcoming its late and unfavorable start. Corn made rapid growth and some is now silking and tasseling. The potato crop, as a whole, is not in an encouraging condition, as the bugs are very numerous and the tubers are not developing satisfactorily. Apple crop still poor; other fruits doing well. Truck looks promising.—*T. F. Townsend.*

Porto Rico.—The mean temperature was 79.0°, or about normal; the highest was 96°, at Coamo and the lowest, 58°, at Ponce. The average precipitation was 12.73, or 5.53 above normal; the greatest monthly amount, 33.58, occurred at Hacienda Perla, and the least, 4.61 at Isabella.

Excessive rains have occurred in the northeastern and southwestern parts of the island, elsewhere the weather has been about normal. The drought has been broken in Ponce and San German districts. In a few localities ground provisions have been injured by continued rains. Coffee is maturing and reports indicate an excellent crop both in quantity and quality. Grinding of cane has continued in some few localities. Much rice has been sown and is doing well. A good crop of corn is being harvested. New cane fields are growing nicely. Minor crops are abundant. Farm operations active.—*E. C. Thompson.*

South Carolina.—The mean temperature was 81.4°, or 1.9° above normal; the highest was 102°, at Batesburg and Longshore on the 25th, and the lowest, 62°, at Walhalla on the 19th. The average precipitation was 4.52, or 1.85 below normal; the greatest monthly amount, 13.25, occurred at Georgetown, and the least, 0.65, at Winnsboro.

Both the slight excess in temperature and the deficiency in precipitation were favorable conditions, and facilitated ridding field crops of grass and weeds that had attained a rank growth during the previous month, and gave opportunity to give crops much needed cultivation. Corn, cotton, and tobacco made great improvement, and the last-named crop was largely cut and cured. Minor crops did well.—*J. W. Bauer.*

South Dakota.—The mean temperature was 78.2°, or 6.0° above normal; the highest was 115°, at Ipswich on the 20th, and the lowest, 34°, at Rochford on the 5th. The average precipitation was 1.73, or 1.03 below normal; the greatest monthly amount, 3.69, occurred at Mound City, and the least, 0.48, at Canton.

The prominent meteorological features of the month were excessively high temperature on many days, unusually protracted periods of heat without relief, and unusually great deficiency in precipitation over much of the State. At Vermillion, Clay County, the temperature reached or exceeded 100° on sixteen days. Late and medium late spring wheat, oats, and late barley were to a considerable extent blighted and the grain shrunken by the excessive heat and premature ripening, and corn, millet, potatoes, flax, and pastures suffered materially from heat and drought. There was some local hail damage to crops at times through the month, and on the 28th some late wheat, oats, and barley remaining uncut were damaged by wind and hail in the northern counties. At the close of the month barley and spring rye harvest was completed, except in some northern counties; spring wheat harvest was completed in the southern counties and progressing rapidly elsewhere, and oat harvest was farther advanced than that of wheat.—*S. W. Glenn.*

Tennessee.—The mean temperature was 81.1°, or 3.1° above normal; the highest was 107°, at several stations on different dates, and the lowest, 45°, at Erasmus on the 9th. The average precipitation was 2.01, or 2.47 below normal; the greatest monthly amount, 7.14, occurred at Bristol, and the least, trace, at Springfield.

The month was characterized by severe drought and extremely high temperature, which proved disastrous to early corn over large portions of the middle and western sections; tobacco, cotton, potatoes, and fruit crops suffered greatly, and gardens were almost ruined. Thrashing of wheat and oats progressed favorably, with generally very good yields. The drought was broken about the 30th, with cooler weather, but not until many fields of early corn had been practically lost.—*H. C. Bate.*

Texas.—The mean temperature was 84.5°, or 1.3° above normal; the highest was 110°, at Haskell on the 19th, and the lowest, 57°, at Mount Blanco on the 10th. The average precipitation was 2.46, or 0.12 below normal; the greatest monthly amount, 9.99, occurred at Brazoria, while none was recorded at Camp Eagle Pass.

Favorable weather conditions prevailed for farm work during the first two weeks of the month, and wheat, oats, and hay were secured in good condition and without interruption; wheat yielded much less than the average crop, and oats, except in a few cases, was almost an entire failure. A fair crop of hay was made. The drought which prevailed over the greater portion of the State, with warm weather and dry southerly winds, ruined many promising fields of corn, destroyed gardens, and dried up some of the smaller water courses. Providence rice was mostly killed and the irrigated crop was badly damaged. Cotton suffered some, and in many sections of the southern portion was infested with boll weevil, but the crop as a whole, while backward, passed through all unfavorable conditions without serious injury. At the close of the month dry weather still prevailed over a large area in the central portion; elsewhere, throughout the State, the drought had either been partially or completely broken by light to heavy showers on the 25th and 26th. Where rain fell a rapid and marked improvement was noted in cotton, sugar cane, millet, sorghum, and late planted corn. Gardens were mostly too far gone to be benefited, and early corn, having for the most part matured prematurely, was practically

made. In the dry sections cotton, while holding its own remarkably well, was beginning to suffer for moisture; picking began in some of the southern counties about the 15th, and by the close of the month a number of bales had been ginned and marketed.—*N. R. Taylor.*

Utah.—The mean temperature was 75.4°, or 2.7° above normal; the highest was 115°, at Hite on the 10th, and the lowest, 27°, at Soldier Summit on the 4th. The average precipitation was 0.41, or 0.19 below normal; the greatest monthly amount, 1.76, occurred at Frisco, while none fell at Corinne and Kelton.

One of the warmest, if not the warmest, months since the settlement of the State.—*L. H. Murdoch.*

Virginia.—The mean temperature was 78.6°, or 1.3° above normal; the highest was 106°, at Stephens City on the 1st, and the lowest, 47°, at Burkes Garden on the 9th. The average precipitation was 4.94, or 0.42 above normal; the greatest monthly amount, 9.82, occurred at Alexandria, and the least, 2.44, at Callaville.

The month, as a whole, was quite favorable for crop growth and work. Extremely high temperatures prevailed during the first and last days of the month, but no crop damage resulted. There were also a number of heavy, washing rains and some freshet water in small streams. These were productive of some harm to lowland corn and tobacco, but not sufficient to materially affect the general situation.—*Edward A. Evans.*

Washington.—The mean temperature was 62.8°, or 2.5° below normal; the highest was 106°, at Pasco on the 30th, and the lowest, 30°, at Snoqualmie Falls on the 12th. The average precipitation was 0.57, or 0.07 below normal; the greatest monthly amount, 2.48, occurred at Ilwaco, while none fell at Ellensburg, Lakeside, and Pasco.

Although rather cool for corn and several kinds of vegetables, the month was the best possible for the heading out and filling of spring wheat. It was also very favorable for haying, and ideal for fall wheat harvesting.—*G. N. Salisbury.*

West Virginia.—The mean temperature was 77.4°, or 3.7° above normal; the highest was 104°, at Magnolia and New Martinsville on the 1st, and the lowest, 47°, at Philippi on the 9th. The average precipitation was 3.16, or 1.63 below normal; the greatest monthly amount, 6.21, occurred at Josiah, and the least, 0.69, at Parkersburg.

Fine harvest weather during the month; wheat cutting completed by the fourth week, and wheat mostly in stack and thrashing begun, but yield not meeting expectations, there not being more than half to two-thirds crop. Clover and rye cutting mostly over by second week, with fair yields. During the third week grass and oat cutting in general progress, and by the last of the month, these crops had been mostly saved in fine condition, with a good crop of hay and a fair yield of oats. Crops of all kinds continued to improve until the fourth week, when the intense heat and drought began to have an injurious effect, especially on corn, gardens, and potatoes. Apples continued to fall, and the prospect was for not more than half a crop; peaches plentiful, but small and of inferior quality.—*E. C. Vose.*

Wisconsin.—The mean temperature was 75.3°, or 5.8° above normal; the highest was 111°, at Brodhead on the 21st, and the lowest, 33°, at City Point on the 7th. The average precipitation was 4.29, or 2.23 above normal; the greatest monthly amount, 9.17, occurred at Florence, and the least, 0.86, at Racine.

The month was characterized by a severe and protracted drought over the southern section of the State, which, together with the excessive heat, caused much damage to corn, tobacco, and other crops. In the central and northern portions the rainfall was ample, and in some localities excessive. In the central and northern sections a large hay crop was secured in excellent condition, and other crops are satisfactory.—*W. M. Wilson.*

Wyoming.—The mean temperature was 71.3°, or 4.4° above normal; the highest was 110°, at Fort Bitter Creek on the 14th and 16th, and the lowest, 23°, at Daniel on the 5th. The average precipitation was 0.70, or 0.39 below normal; the greatest monthly amount, 2.87, occurred at Casper, while none fell at Embar and Hyattville, and but a trace at Lander and Fort Washakie.—*W. S. Palmer.*

SPECIAL CONTRIBUTIONS.

THE THUNDERSTORM; A NEW EXPLANATION OF ONE OF ITS PHENOMENA.

By BYRON MCFARLAND, A. B., dated Monroe City, Mo., June 17, 1901.

The daily weather maps issued by the United States Weather Bureau show that areas of high pressure, and areas of low pressure—or highs and lows—are continually passing across the continent in a more or less easterly direction. Thunderstorms occur usually in these lows and are therefore called secondary storms, being small, local storms in a large, or general, storm area. These storms furnish the chief supply of rain during the summer months. There can be little doubt but that thunderstorms are composed of rising air and descending air; the air currents blow both *to* and *from* the thunderstorm—both *up* and *down* in it. A peculiar feature of the thunderstorm is the coolness of the air within it. At the storm's arrival the temperature may drop from 10° to 30° F., or even more.

Some of the facts known about thunderstorms are as follows: (*a*) from some distance in front the air blows toward the storm, turns upward as it approaches it, and finally enters the main cloud. (*b*) On the ground below the margin of the cloud the air blows from the cloud; this forms the "squall" or strong cool wind that usually precedes the main storm proper. (*c*) In the center of the storm, the air is more nearly calm than at the border—especially its front border. (*d*) The air pressure is greater in the center of the storm than just in front of the margin of the cloud, i. e., the barometer rises slightly, and generally suddenly, during the passage of the cloud. (*e*) The air in the "squall" is considerably cooler than the surrounding air.

To account for these phenomena of pressure and of air currents (*a-e*) three explanations have been offered: (1) The rain drops falling through the air, push it down and out, thus producing the rise of the barometer and the "squall" below. (2) The warm moist air rising into a region of decreased air pressure, becomes cloud and expands, and in thus pushing aside the surrounding upper air it presses downward with more than its weight, causing at once the slight rise in the barometer at the ground and the outrushing squall. The ascending air produces therefore a sort of recoil comparable to the "kick" of a gun, and this recoil is what "kicks" out the squall below. (3) The rising air above overflows into the neighboring air, and this additional weight produces the increased pressure and the squall below.

(1) The first of these explanations has undoubtedly some foundation in fact, for falling bodies will produce descending currents and lateral winds below. But the fact that the intensity of the squall is not always proportional to the intensity of the rainfall shows that the theory is only a partial explanation of the phenomena in question. (2) The second-named theory is even less tenable. That cloudy air in ascending cools more slowly, and hence expands more rapidly than dry air, is quite true; but this expanding air can not "kick" a constant squall out of the bottom. I will admit that should a large mass of warm, cloudy air be in some way carried up to the center of the convectional column and there suddenly turned loose, it would expand and increase temporarily the pressure down at the ground. But the thunderstorm is a continuous process of some duration. The following statements appear to me as being in this connection unquestionably true, viz, (1) the pressure at the ground could not be increased without the pressure above being also and even first increased; (2) the increased pressure at the ground could not be maintained (as it in fact is) unless the increased pressure above be maintained; and (3) if the increased pressure above be maintained, convection would cease, and the thunderstorm would be brought at once to an end.

In my judgment, the only condition under which air can continue to rise for hours into the upper part of the storm is the presence there, not of increased, but of relatively decreased air pressure. The idea that the rising and expanding air above can maintain a constant downward recoil or "kick" sufficient

to produce the squall, and at the same time not interfere with the incoming currents above, seems hard to understand. For it could not "kick" at all unless its pressure be increased; and if its pressure be increased, it would "kick" in all directions, and would "kick" back the incoming currents and prevent them from entering the storm area at all. The surrounding air could not enter until the high pressure had given way to lower pressure; but when this takes place, the high pressure on the ground would also give way to lower pressure, and the squall would cease. But, in fact, both the inflowing currents above and the outrushing squall below blow with comparative uniformity, thus showing that there are some sort of constant barometric conditions established, which insure a low pressure above and a relatively high pressure below.

(3) The "convectional overturn" theory has the same weakness that the "kick" theory has, because (*a*) the upper air could not "overflow" until its pressure be greater than that of the surrounding air; (*b*) if the overflowing air above has relatively greater pressure, it will produce greater pressure below also, unless the column is abnormally warm or light, and we should have the anomaly of air rising into relatively higher pressure and settling in lower pressure.

The explanation which I wish to suggest is based on the well-known coolness of the air in the squall. Under uniform pressure, the density of the air decreases 1/491 of that at 32° F. for every degree Fahrenheit above the freezing point of water.

We will suppose the distance from the thundercloud to the ground to be 1,300 feet (it may be more), and suppose, also, that the air between the cloud and ground is, on an average, 15° F. cooler than the surrounding air (it is often considerably more). It may easily be found that the difference in weight of these two columns of air (each 1,300 feet high) would be about 0.04 inch of mercury, that is to say, placed side by side, the cool column would support 0.04 inch more mercury than the warm column would. Evidently, if the air be much cooler (say 35° F.), and if the height of the cool column be several thousand feet, the difference in weight would be much more marked. The presence of this cool column of air, then, extending from the cloud to the ground, will account for the higher air pressure below. But not only this, it will account, also, for the permanent low above. If a series of isobars be drawn in a vertical plane section through the thunderstorm, the isobaric surfaces will crowd together in the cool column and be farther apart in the surrounding region of warm air. The higher pressure below will suffice to produce the squall, and the lower pressure above will permit convection to go on undisturbed.

The rise in barometer during the passage of a thunderstorm is usually very slight. I have often noted, in well defined storms, a rise of not more than 0.03 inch. In very violent storms, however, the rise may be considerably more, as much as 0.15 or even 0.25 of an inch. But it is a notable fact that in these violent storms, the drop in temperature is very marked. This is just what we should expect if the "cold air" theory is true. I have yet to hear of a thunderstorm accompanied by a typical squall in which the air of the squall was warmer than the surrounding air.

The "cool air" theory will undoubtedly suffice, provided only the cool air column is present. And as indications that the column of cool air does exist, we mention the following: (1) The internal air of the squall is considerably cooler on the ground. (2) The fact that the so-called wind cloud is usually much lower than the other convectional clouds which are fed from air of like temperature and humidity, shows that the rising air meets with relatively cooler air below the margin of the cloud.

There are, of course, several things to be remembered in applying this "cool air" theory. Confessedly there are still a good many "unknowns" in the thunderstorm; but the following will evidently modify and determine the violence of the squall. (1) The average difference of temperature between the cool column and the surrounding air. (2) The height of the cool column. (3) The diameter of the cool column. (4) The progressive motion of the storm itself. No one of these four will alone determine the violence of the squall. In general, the intensity of the squall will vary directly with the relative coolness of the column, its height, and its diameter. But these factors may vary considerably among themselves, and there can be no narrow, cast-iron rules laid down. We should expect to find the squall strongest when these factors combine and weakest when they are weak.

The progressive motion of the storm will affect the squall somewhat, making it apparently stronger in front than behind.

As to the origin of the cold air of the squall there is some diversity of opinion. By some it is thought that the coolness of the air is due to cold rain falling through it. In many cases this seems a sufficient explanation. Thunderclouds probably often extend above the snow line. The melting of this snow, the warming of the cold water in its descent, and the resulting evaporation of some of it, might well keep the air through which it falls several degrees cooler than the outside air. The amount of air that rises into the thunder cloud is apparently several times greater than that which blows out from it below. The falling snow and rain cool a comparatively small amount of air beneath the clouds.

Cool squalls in the absence of rain are thought to be caused by the settling of overlying masses of air that are intrinsically and abnormally cold. This is entirely probable. It is generally supposed that thunderstorms, especially those accompanied by tornadoes, are overlaid by layers of cold air. But it is more probable, I think, that many of the wind clouds, unaccompanied by rain, are the last remnants of former thunderstorms, or are the products of actions that were too feeble to produce a thunderstorm.

It seems pretty certain that the circulation of air in an active or "typical" thunderstorm is as about as follows: The air from around rises toward the cloud; the inner layer of this ascending air meeting with the falling snow or rain is cooled, and also pushed down by the rain drops; both cooling and pushing cause it to be turned downward. And as it is more and more cooled (i. e., relatively), and continually beaten down by the falling rain, it settles more and more rapidly, and on reaching the ground becomes the cool outrushing squall. The presence and the appearance of the so-called "wind cloud" that generally just precedes the rain cloud, seems to indicate this. It is a long light-colored fleecy cloud that suggests a huge roll of wool. A cloud formed at the level where the rising air turns to descend would have an appearance like this.

A METEOROLOGICAL BALLOON ASCENSION AT STRASBURG, GERMANY.

By A. LAWRENCE ROTCH, Direct r of the Blue Hill Observatory, dated Aug. 7, 1901.

Through the courtesy of Professor Hergesell, the President of the International Aeronautical Committee, the writer (who is the American member of the Committee) participated in the eighteenth series of balloon ascents on July 4, 1901, when balloons were dispatched from Paris, Berlin, Strasburg, Munich, Vienna, and St. Petersburg. The manned ascension from Strasburg was made by Professor Hergesell and the writer in the new cotton balloon "Girbaden," of 1,300 cubic meters, belonging to the Aeronautical Society of the upper Rhine. On this occasion this balloon was filled with coal gas and had a lift at starting represented by sixteen sacks of ballast weighing together about 300 kilograms.

Two *ballons-sondes*, one of paper the other of silk, carrying self-recording instruments, were sent up at 3 a. m. and 8:35 a. m., respectively. They traveled in a south-southwest direction, but not very far, reaching a maximum height of about 8,000 meters. The "Girbaden" left the ground in a light rain at 9:05 a. m., rose through two strata of clouds to a height exceeding 4,000 meters and after a voyage of a little more than three hours a sudden descent, to escape a threatenstorm, landed us in the Vosges Mountains, near the town of Ammerschweid, a few kilometers northwest of Colmar and about 75 kilometers south-southwest of Strasburg. The observations of temperature and humidity were made every few minutes by Professor Hergesell with an Assmann aspiration psychrometer, hung outside the basket of the balloon and several feet distant therefrom, but drawn near to it for reading, and when it was necessary, to wet the bulb of the thermometer. Simultaneous observations of pressure were made by the writer with a large aneroid barometer, of which the corrections were determined under an air pump previous to and subsequent to the ascension. A portable barograph, belonging to the writer, registered continuously the approximate heights and showed at every moment whether the balloon was rising or falling. The detailed observations follow:

Ascent of "Girbaden" (1,300 cubic meters of coal gas) from Strasburg, July 4, 1901, with Prof. H. Hergesell and A. L. Rotch.

Time. A. M.	Bar. (cor'd)	Height above sea.	Aspiration thermometers. Dry.	Wet.	Vapor press.	Dew-point.	Rel. hum.	Remarks.
H. m.	*Mm.*	*M.*	*° C.*	*° C.*	*Mm.*	*° C.*	*%.*	
...	756.5	0	16.5?	...	...	...	...	
9 05	...	143	15.4	15.4	13.00	15.4	100	Rose from Steinthor; light rain.
08	709.7	525	12.7	...	...	...	...	Moving south over Strasburg.
10	702.3	630	12.0	...	...	...	...	In clouds.
12	695.8	720	11.4	11.4	10.03	11.4	100	Clouds thinner
16	690.6	775	11.2	11.2	9.90	11.2	100	Four sacks of ballast thrown out.
17	685.3	830	10.9	10.9	9.70	10.9	100	
20	679.0	925	10.4	10.4	9.39	10.4	100	Clouds very thin. Insolation felt.
22	672.8	1000	...	...	...	...	...	Sun appears; we are on upper edge of cloud.
24	668.6	1055	10.3	10.1	9.11	10.0	98	Below us is a sea of clouds; above is a broken cloud sheet, presumably alto-stratus.
27	660.8	1155	9.5	9.0	8.33	8.6	94	
30	...	...	...	...	...	...	...	In north-northwest in neighborhood of Vosges Mountains are turretted cumulus.
32	...	...	...	...	...	...	...	One-quarter sack ballast out
33	641.4	1395	8.2	7.8	7.71	7.5	95	Cloud sea broken, permitting fields and a village to be seen below.
35	...	...	...	...	...	...	...	Three-quarter sack ballast out. We are going parallel with the railway to Basel
36	632.3	1500	7.5	7.1	7.35	6.8	95	
42	618.7	1690	6.8	6.4	7.00	6.1	95	
43	610.1	1800	5.9	5.4	6.49	5.0	94	One sack ballast out.
54	598.0	1975	4.8	?	...	...	...	
56	...	...	...	...	...	...	...	We decide to traverse upper cloud stratum, and throw out one sack ballast.
58	586.5	2150	5.0	3.0	4.88	0.9	75	
10 00	583.5	2190	3.7	2.2	4.76	0.6	81	Cumulus below; the cloud stratum above has become dense stratus.
02	...	...	...	...	...	...	...	One sack ballast out.
06	575.4	2250	3.0	2.9	5.58	2.8	99	Balloon follows exactly the bed of the Ill.
08	...	...	...	...	...	...	...	One sack ballast out.
11½	561.4	2480	2.3	2.0	5.16	1.7	96	We enter upper cloud.
14	...	...	...	...	...	...	...	One sack ballast out.
15	555.4	2565	1.4	1.4	5.05	1.4	100	In clouds; sun faintly seen.
16½	545.4	2715	0.9	0.8	4.80	0.7	99	Upper limit of cloud.
18½	540.4	2785	0.1	− 0.4	4.26	− 1.0	92	Thermometer of aneroid in sun +19°. Above us is clear, deep-blue sky; beneath us unbroken sea of clouds; in southwest high cumulus summits (cumulo-nimbus) with cirrus.
29	515.1	3150	−2.1	− 2.8	3.48	− 3.7	89	
34	508.5	3260	−3.8	− 4.2	3.22	− 4.8	93	
38	506.9	3295	−3.6	− 4.2	3.16	− 5.0	90	
41	500.3	3400	−3.7	− 4.2	3.19	− 4.9	91	
45	...	...	...	...	...	...	...	One sack ballast out
47	490.5	3560	−4.0	− 4.2?	...	...	...	Wet bulb probably not in order.
50	484.3	3660	−4.0	...	...	...	...	
11 04	475.6	3805	−4.7	− 5.7	2.68	− 7.2	83	
11½	462.6	4060	...	...	...	...	...	
13	462.1	4067	−7.6	− 9.2	1.79	−12.3	69	
16	...	...	...	...	...	...	...	One sack of ballast out.
21	457.9	4120	−7.3	−10.5	1.09	−18.3	41	
23½	455.3	4160	−6.7	− 9.4	1.43	−15.1	51	
25½	454.6	4170	−6.8	−10.2	1.08	−18.4	41	Maximum height. Temperature measured several times.
27	458.7	4110	−6.8	− 9.7	1.31	−16.1	48	
36	458.7	4110	−6.4	− 9.3	1.38	−15.5	48	
P. M.								The great cumulo-nimbus clouds approach nearer and nearer, and the gray masses can be seen boiling up. Since there is danger of being drawn into a thundercloud we decide to descend at once. Repeated pulls of the valve cause the balloon to fall rapidly, and in five minutes it reaches the upper cloud stratum and descends quickly through it. Between the two cloud strata there is some sunlight. We sink into the lower cloud that reaches low down and only discover, when near the ground, that we are above the forests of the Vosges Mountains. The balloon rapidly traverses a town, later found to be Kaisersberg. With the drag rope touching the ground we cross the spur of a mountain, between Kaisersberg and Ammerschweir, and land at 12h. 13m. in scrub wood two kilometers from Ammerschweir. Immediately after landing there was a squall, with heavy rain.
12 23	725.0	365	16.0	14.6	11.67	13.7	86	Cumulo-nimbus moving from north-northeast, with rain in mountains.

DIURNAL WINDS ON FAINT GRADIENT IN NORTHWESTERN NEW MEXICO.

By Prof. RICHARD E. DODGE, of Columbia University, New York.

The diurnal winds that have been observed during the last three summers in northwestern New Mexico deserve note because of the gentle gradient along which they move. The winds in question occur regularly in the canyon of the Chaco River, one of the southern tributaries of the San Juan River, which is in turn a tributary of the Colorado River. The valley has an east-west extent for nearly ten miles, and it is in this stretch that the winds have been observed, the observer having his station in the middle of the stretch at Pueblo Bonito, now the post office at Putnam, N. Mex.

The valley throughout the stretch in question is a little more than one-half mile in width, and is bordered by mesas averaging 250 feet in height. The north mesa rises nearly vertically for 100 feet, but the south mesa has a gently sloping shale slope at its base that is approximately 50 feet in height. The gradient of the valley in the stretch noted is a little less than ten feet to the mile.

The west wind sets in between 9:30 and 10:30 a. m., and usually about 10 a. m. It may first be noted as a gentle breeze just stirring a flag. The wind increases slightly in intensity as the day advances, reaching a maximum in the early afternoon. After midday local overturnings forming large dust whirls may frequently be observed. From 4 to 7 p. m. the wind usually decreases in intensity, and a dead calm

for a half hour, or an hour, may succeed the breeze. Between 8:30 and 10:30 p. m., and usually between 9 and 9:30, p. m., the breeze begins from the east, being at first but a quiet movement, just observable to the moistened finger. The breeze increases as the night advances, and usually reaches a maximum about 4 a. m. From that hour until the west wind sets in, the movement decreases and there may be a calm.

The wind has been observed during July, August, and September, but it is of more frequent occurrence in the dry season, which this year ended on July 21. From July 9 to July 21, 1901, the wind change occurred daily, with the exception of three days, during the passage of a slight low pressure area. During the remainder of July and the first part of August rains occurred almost daily, and the normal winds were disturbed, especially in the daytime. The night wind occurred on nearly every fair night, but the day wind frequently blew from the south or southwest rather than west, and usually changed to east before a shower.

Mountain and valley breezes are frequent in the mountain valleys of steep grade in the Western States, and, as noted by Mill (Realm of Nature, p. 128), campers and cowboys build their fires so as to have them to leeward of camp when the wind sets in; but it is believed that mountain and valley breezes on such a faint gradient as that noted above have not been often recognized and described.

ORIGINAL MEMOIRS ON THE GENERAL CIRCULATION OF THE ATMOSPHERE.[1]

Compiled and annotated by MARCEL BRILLOUIN, Paris, 1900. Historical introduction translated by the Editor.

INTRODUCTION.

Ever since the first expedition of Christopher Columbus, navigators have known that permanent east winds prevail on both sides of the equator. Emanating from near the Tropics, these winds move first toward the equator and turn more and more toward the west. A rainy zone of equatorial calms separates the two belts of trade winds. Beyond the trade winds and nearer to the poles the west winds blow with much less regularity. Sailing vessels make use of these west winds for the return voyage from America to Europe in the same way that they have utilized the trades to go from Europe to America. Such are the facts as they were generally known when, in 1686, there appeared in the Philosophical Transactions of London a memoir by the astronomer Halley, who had himself sailed through the Tropics and collected numerous observations on the trade winds and the monsoons. In place of the ridiculous explanations which had appeared in the preceding years in these Transactions, Edmund Halley introduced the expansion of the atmosphere under the influence of solar radiation. The air should flow downward toward the warmest point, expand under the action of the sun, and, rising again, spread itself out in every direction. But this, which explains the movement of the air from the poles toward the equator, would require west winds in the morning alternating with east winds in the evening, instead of permanent east winds. It was not the trade winds, but only their diurnal variations, that were explained by Halley; it was a play on words that attributed to the progress of the maximum temperature from east to west, in the train of the sun, the power to carry the movement of the air along in the same direction. In these ideas the apparent motion of the sun was alone considered; the true rotation of the earth had no rôle attributed to it.

Nearly fifty years passed by before, in 1735, this latter influence was recognized by another English astronomer, George Hadley (the brother of John Hadley, the inventor of the sextant), in a memoir entitled: "Concerning the cause of the general trade winds." The air coming from the temperate regions toward the warm equatorial zone arrives at parallels which are farther and farther from the earth's axis of rotation, and whose linear velocity from west to east is greater and greater; the air therefore remains behind. This retardation is really much less than the 87 miles an hour that the change of latitude from the Tropics to the equator would seem to indicate, because all along its course the air is partially carried forward by the surface of the earth over which it flows. Moreover,

> * * * the northeast and southeast winds which prevail between the Tropics must be compensated somewhere by northwest and southwest winds, and generally the winds from any quadrant whatever must be compensated by opposite winds elsewhere; unless this were the case the rotation of the earth on its axis would not be maintained.

The air that has risen above the equatorial zone has maintained a velocity from west to east nearly equal to that of the equator itself; it overflows above the air of the trade winds, redescends toward the poles and appears beyond the Tropics as a west wind; but Hadley does not explain the meridional component of these west winds. Although the influence of the motion of the earth is not correctly estimated, yet this memoir is fundamental; it remained, however, unknown for nearly a century.

Hurricanes or cyclones alone attracted the attention of meteorologists during the first half of the nineteenth century. Nevertheless, in 1825, Leopold de Buch expressed the opinion that the counter trade winds descend to the surface of the earth toward the Tropics, and flow toward the poles; but if this be the case, how is the circuit completed, and how are the trade winds fed? He does not even ask himself these questions.

In 1855, in the Physical Geography of the Ocean, Maury gave the first Schematic chart showing the circulation of the air on a uniform earth. Maury assumed, without, however, giving reasons satisfactory even to himself, a singular intercrossing of currents at the poles, the Tropics, and the equator.

The following year, 1856, his compatriot, Ferrel, at Nashville, Tenn., not being satisfied with Maury's book, published in an American medical journal, an entirely different drawing. According to him the atmosphere is subdivided into six zones of independent circulation, separated by belts of motion alternately ascending at the equator and along the polar circles, and descending along the Tropics and at the poles. A minimum pressure prevails at the equator and in the polar regions; a maximum pressure prevails on the twenty-eighth degree of latitude.

This memoir by Ferrel was soon followed by a purely mathematical memoir on the motion relative to the surface of the globe. The equations adopted in this memoir are the strict equations of relative motion; the centrifugal accelerations are introduced into it in a natural and complete manner as a consequence of the passage from fixed coordinates to coordinates moving with the earth. Ferrel showed the

[1] Professor Marcel Brillouin, of Paris, has lately published a French translation or summary of a number of important meteorological memoirs under the general title of Mémoires Originaux sur la Circulation Générale de l'Atmosphère. He has enriched this volume with numerous notes—historical, explanatory, and critical—so that it forms an important and convenient introduction to the study of the hydrodynamic problems that are presented by the earth's atmosphere. It is also the best introduction to Brillouin's famous memoir of 1898, entitled Vents contigus et Nuages. The introduction to this volume consists of an interesting historical memoir by Brillouin, which we take the liberty of publishing in full in the accompanying translation, believing that the readers of the MONTHLY WEATHER REVIEW will profit by Brillouin's criticisms and will not be misled by one or two passages, in which he gives the views of de Tastes as to the importance of the Gulf Stream and the Kuroshiwo rather more prominence than would seem necessary in the present state of our knowledge.

preponderating rôle of the horizontal components of the centrifugal acceleration due to the horizontal movements of the air; one of these only, the one perpendicular to the meridian, had already been introduced by Hadley; the other, the meridional component, is no less important. Reasoning first upon an atmosphere that is not subject to any resistance either from internal friction or from the action of the earth, Ferrel showed that the free surface would be depressed at the equator, inflated at the Tropics, and would descend again to the level of the earth near the polar circles; the polar cap would be entirely devoid of atmosphere. However extensive the modifications due to the resistances may be, they can not entirely destroy these characteristics; the depressions of the poles and of the equator must exist in the true atmosphere, and the two zones of maximum pressure must exist near the Tropics. Not being able to introduce into a rigorous demonstration resistances, of whose mathematical laws we are ignorant, Ferrel continued his study of the true atmosphere, explaining in a generally plausible manner the mode of action of these resistances and the disturbances that may be produced by them. He showed finally that these resistances must play only a very small part in the equation which unites velocity of the wind from east to west with the variation of pressure along the meridian; it is by means of this equation that Ferrel computed the velocities of the wind and draws his diagrams, taking as his point of departure the mean distribution of the pressure observed at sea level and its variation with height, according to Laplace's formula.

One can not too much admire this collection of memoirs by Ferrel; by the closeness of his reasoning, whenever it is possible, and the delicacy of his perceptions, the student of Nashville is the worthy predecessor of von Helmholtz.

At the same epoch and in an independent manner James Thomson, profiting by an idea expressed by Murphy (1856) as to the cause of the polar depression, proposed a simpler representation at the meeting of the British Association at Dublin (1857). Only an extract then appeared, the figure shown in 1857 not being published until 1892 in the Bakerian lecture given by James Thomson, "On the grand currents of atmospheric circulation," a few months before his death. Without changing his theoretical point of view, but making more and more use of the results of observation, Ferrel published in 1860, and again in 1890, two diagrams sensibly differing from the first.

It is to be remarked that there is no modification of Hadley's point of view; without solar action the atmosphere would be in a state of repose. The action of the sun sets it in circulation along the meridians; the rotation of the earth changes this motion. The parallel of relative quiescence is determined by the condition that the total action of the atmosphere upon the earth should be *nul*. This is very nearly the same point of view as that which predominates in subsequent works; but the rotation takes the first place.

In 1886 W. Siemens published a theory which rests upon a very questionable principle: If the atmosphere were carried along by the earth without any relative motion, this entrainment would give it a large living force of rotation. Let us now suppose that the atmosphere were thoroughly mixed: Siemens admits that as a consequence of the mixture a uniform distribution of the linear velocity in the whole mass would result; he admits, furthermore, the conservation of the living force of the whole. On these conditions the general linear velocity would be 379 meters per second, or the same as the velocity of the earth at latitude 35° 16′. On the interior of a cylinder having this parallel for a base the entire depth of an atmosphere of uniform temperature would be occupied by west winds, with east winds on the outside. The inequalities of temperature produce a meridional circulation which combines with the preceding.

This memoir by Siemens is not perfectly clear, but as it marks his return to the study of the general circulation after thirty years of indifference, it seems useful to translate it in full.

The following year, 1887, Mr. Möller published a work of much closer analysis, but of a mixed character, analogous to that of Ferrel's works, in the sense that he borrows some of his results from observation. Although in the memoir itself it is often difficult to see to what extent the theoretical deductions are guided by a knowledge of the true circulation, several passages have a real interest, particularly the analysis of the part played by the resistance that the ground opposes to the motion of the air.

A discussion, which the vague character of Siemens' views contributed to render somewhat confused, was carried on for several years between Siemens, Möller, Sprung, and Oberbeck in the Meteorologische Zeitschrift; it does not, however, seem to me necessary to extract anything from it.

A little later Oberbeck (Acad. des Sciences, Berlin, 1888), adopting the simplest distribution of temperatures with latitude capable of producing a maximum at the equator and a minimum at the poles, i. e.,

$$T=\left(Ar^2+\frac{A'}{r^3}\right)(1-3\cos^2\theta),$$

where $T=$ temperature; $\theta=$ latitude; $r=$ radius to earth's center; $A, A'=$ constants, and seeking to take into account the internal friction of the air, but neglecting its compressibility, obtained the following results:

On account of the difference of temperature, the air rises between the equator and latitude 32° 16′, and descends from thence to the poles. The velocity of the descent at the pole is double the velocity of ascent at the equator. The horizontal meridional velocity, zero at the pole and at the equator, attains its maximum at a latitude of 45°. The vertical velocities, zero at the surface of the earth, are everywhere very small in comparison with the horizontal velocities.

The motion along the parallels of latitude due to the reaction of the rotation of the earth upon the thermal circulation, is superposed upon two others: (1) A current flowing toward the west which prevails between the equator and latitude 35° 16′; beyond this latter the current flows toward the east; it is annulled at the poles (as a consequence of the friction). (2) A current flowing toward the east which is zero at the surface of the earth, zero at the equatorial plane, and zero at the poles, but increases very rapidly with altitude and has a maximum at latitude 54° 44′.

From the combination of these three movements (meridional, rotational, and vertical,) there results as the trajectory an open curve, the concavity of which, for movement in the lower strata, is open toward the west, but for the upper strata, toward the east; as its velocity north and eastward is much greater than it is at the surface of the earth, the upper branch of the trajectory crosses the lower branch at about latitude 54°. In the absence of determinations of the coefficient of friction of the air, Oberbeck did not seek in this first memoir to deduce the velocity of the wind from the observed temperatures. Several months later, changing his point of view a little and correcting a rather important theoretical lapsus, Oberbeck determined the velocities produced in the Southern Hemisphere by the mean observed distribution of the pressures, according to his theory, supposing the influence of the inequalities of temperature upon the pressure to be negligible. He thus found a west wind between the pole and latitude 16° 49′, whose maximum velocity is 4.59 meters per second at latitude 56° 27′. Between 16° 49′ and the equator the wind blows from the east, with a maximum velocity of 13.5 meters at the equator, in place of

the equatorial calms. This is a computation analogous to that of Ferrel, but under a different analytical form.

Siemens and Oberbeck, as we see, return to the circulation over a whole hemisphere, which Ferrel had seemed to wish to abandon in the beginning of his works. Under these conditions, in order to avoid the extreme velocities that the principle of the conservation of areas seems to impose, it is indispensable to introduce the resistances. Oberbeck has imposed upon himself well-chosen limiting conditions: at the lower surface, entrainment by the terrestrial globe, which is not far from the truth in the permanent condition; at the upper surface, although but a little distance from the surface of the earth, a total absence of vertical movements. But, in order to take into account the internal viscosity of fluids, he has adopted equations of the same form as those for small, slow motions, with a resistance in proportion to the velocity of deformation, reserving the right to adopt a value of the coefficient of friction certainly very different from that of the laboratory experiments.

Unfortunately, this resistance, which is a linear function of the relative velocities, is for rapid and general motions, not in accordance with the facts. It is well known that the mechanism of the resistances in the rapid motions of great fluid masses is not the same as that of the slow motions of the laboratory; it is the square of the relative velocities that must be considered, and not the relative velocities themselves.

It is to Helmholtz, who had already done so much to explain the boundary conditions in hydrodynamics and hydraulics, that we owe the introduction of true ideas as to the motions of an atmosphere at the surface of a revolving globe.

In his first memoir on the motions of the atmosphere (Sitz. Ber. kön. Pr. Akad. Berlin, 1888), Helmholtz shows the inadequacy and the slowness of the action of the internal viscosity and of the conductivity of gases. He afterwards establishes, by an analytical method, the characteristics of the distribution of pressure in a mass of dry air in convective equilibrium, with rotation, and deduces from this the inclination and the condition of stability of the separating surfaces of two separate annular masses of air. In the normal case, "which experiences only local exceptions under special conditions," the temperature and the radius of calm[2] diminish together from the equator to the poles. The surface of separation rises, therefore, toward the polar side, but remains included between the pole and the horizon. Near the equator it grazes the horizon. The atmosphere is thus formed of an infinite number of layers, in which the velocity and the temperature vary continuously. The warming of the air below or its cooling above produces an active vertical circulation, which mixes together the various layers of the atmosphere and puts them in convectional equilibrium. The heating above or the cooling below, on the contrary, leaves the layers intact.

The resistance of the ground retards the west winds and displaces the air forming them toward the pole as long as it remains at the surface of the earth, then forces it to rise. On the other hand, the resistance of the earth accelerates the east winds and pushes them toward the higher parallels, close to the ground. It is only within the equatorial circle itself that the east winds leave the surface and rise in the plane of the equator itself up to the extreme limits of the atmosphere.

At the surface of stable separation of two contiguous rings of different velocities, billows should originate which, for a certain length of wave, will constitute a more stable form than that of the uniform surface of revolution. These billows, spreading themselves perpendicularly to the meridians, may increase and break up into whirls or rolls and give rise to whirlwinds and cyclones. According to a modified paragraph, in a second memoir, Helmholtz states, that, in consequence of the low temperature at the poles the air flows down close to the ground under the form of east wind or anticyclone; above, the warm layers flow toward the pole to fill up the vacuum and continue their course as west wind or cyclones.

Broken up by the irregularities of the surface of the ground the anticyclonic movement of the lower strata, and the vast cyclone gradually increasing in the upper strata, which one should otherwise find at the pole, break up into a great number of irregular, straggling anticyclones and cyclones, the latter predominating.

From these considerations, I conclude that the principal obstacle to the development of winds much more violent than those which we now observe consists less in the friction of the surface of the earth than in the mixture of layers of air animated by different motions due to whirls formed by the rolling up of the surfaces of discontinuity. In the interior of these whirls the layers of air originally separated are rolled one around the other into more and more numerous and thinner layers; the enormous extent of the surfaces of contact makes possible a rapid exchange of temperature and an equalization of the motion by friction.

In his second memoir (1889) Helmholtz shows that, in the case of dry air, in a condition of stability and with decreasing temperature from the equator to the poles the mixture forms an ascending ring [around the globe] between the two rings [or zones] whence it proceeds. In the two neighboring rings the air at the bottom is thus pushed toward the surface of separation where the difference of the velocities increases.

Easterly winds may even occasionally blow from the polar side. On account of the numerous local disturbances in the great atmospheric currents, no continuous line of separation will, as a general rule, form; it will be broken up into separate parts which will appear as cyclones.

Thus, continuity should exist in the upper regions of the atmosphere; it is below that we must seek for the origin of the breaking waves and billows. These latter show themselves only when the lower air is saturated to its utmost capacity; each wave crest then appears like a cloud; the sky is covered with bands of parallel cirrus clouds. When the surface of separation is only a short distance above the ground the passage of each cloud is manifested by a gust of wind.

In the rest of the memoir of 1889 and in the memoir of 1890 Helmholtz occupies himself only with the formation of the waves in the atmosphere and the conditions for forming breakers or foamers. It is a difficult mathematical theory in point of detail, interesting without doubt, but only a side issue from the point of view of general meteorology. The essential instability is, as I believe I have shown elsewhere (Marcel Brillouin, Vents contigus et nuages. Ann. du Bur. Cent. Met., 1898), produced by the variations of temperature and cloudiness upon a surface originally stable and is not that which results from the waves.

Up to the present time I have only spoken of foreign memoirs. I would mention only one purely theoretical French memoir on the general circulation, viz., the one published by myself "Vents contigus et Nuages" in the Annales du Bureau Central Météorologique, 1898. In this memoir I tried to point out the modifications that the presence of the clouds or of aqueous vapor introduces into some of von Helmholtz's conclusions, and I principally directed my efforts upon the study of the forms of clouds produced by the mixtures.

I have systematically omitted all the memoirs, foreign as well as French, which deal with "the trajectories of inertia at the surface of the earth." It would simplify the problem too much to suppress the moving forces due to the inequalities of pressure and to compare the motions of a mass of air with those of a material heavy point.

In order to enable the reader to judge of the scientific value of the memoirs contained in this volume and to appreciate their influence upon the progress of general meteorology, it seems to me necessary to give here a glance at the

[2] That is, the calm layer, or the surface of separation between the two moving layers.—Ed.

point adopted by those French meteorologists who have interested themselves in the general circulation of the atmosphere; it will thus be less difficult for us to form our conclusions.

It is Mr. Maurice de Tastes who, in his various notes to the Comptes Rendus from 1867, and in his memoir on the Theory of Atmospheric Circulation[3], inaugurated a new manner of regarding the general circulation of the air by adopting as a basis to construct his theory the earth and the oceans as they are described to us in geography, instead of the fictitious, uniform earth which is the object of purely speculative theory only.

Starting from a certain number of well established facts, such as the existence of the regular winds, the trade winds, the monsoons, and the ocean currents, the distribution of temperate or extreme climates, their relation with the division into continents and oceans, and with what we know of the hydrodynamics of elastic fluids, why should we not rush boldly forward with our hypothesis and imagine a system of atmospheric circulation which takes account of known facts. This system once established, let us see whether the later facts revealed to us by subsequent observations will confirm the hypothesis or tend to modify it.

Struck with the excessive importance attributed to the vertical motions of the air which "in the totality of the atmospheric motions are negligible in comparison with translatory motions parallel to the surface of the globe," M. de Tastes is led, in a first sketch, to consider only the motions tangential to the surface of the globe and to neglect the motions in the normal direction which are of importance only in local meteorology.

This aerial film covers a heterogeneous surface, formed on the one hand by the oceans, whose specific heats are considerable, and whose emissive and absorbing powers are very feeble; on the other hand, by continents whose surfaces have much smaller specific heats and emissive powers more or less energetic.

The diathermic air is warmed only by its contact with the surface of the globe; it is warm and dilated between the Tropics, cold and condensed at the poles, whence arise the double motion, in consequence of which the cold air coming from the pole and the warm air coming from the equator, "should, in the temperate latitudes, attain nearly the same density, and form contrary currents, no longer superposed but in juxtaposition."

The rotation of the earth, and the distribution of the warm marine currents, determine the position of the aerial currents. The air which reposes upon the warm waters of the Gulf Stream, and which is maintained at a high temperature by contact therewith constitutes a long trail of warm, dilated gas which facilitates the translatory motion of the equatorial air toward the polar region, and to a certain extent serves to stimulate it. The oceanic Gulf Stream determines the formation of a veritable aerial Gulf Stream, which—

After having approached our western coasts continues its course eastward across the north of Europe where the vapors, of which it is composed, are condensed either as rain or snow; it irrigates Sweden and Finland and returns across eastern Europe in the form of a dry, cold wind. In proportion as it approaches the equator it is heated and becoming northeasterly in southern Africa it contributes to the sterility of the deserts which it traverses and reappears upon the west coast of Africa and thus completes a vast circuit, a sort of aerial river, which surrounds a region of relatively calm air.

Zone of calm with high pressures; low pressures in the current "because the air there is in motion;" slow undulations of this current ending sometimes, but rarely, in the formation of violent vortices on the left side of the current which, in our hemisphere, is the most rapid side; such are the principal consequences of this condition of things.

All the vicissitudes of our climates depend upon the oscillations performed by this zone of calms and the aerial current surrounding it about their normal location; and it is upon the careful observation of these changes that the solution of the great problem of weather predictions depends, which has always been the principal object of the efforts of meteorologists.

An analogous circuit, more extended but more fluctuating on account of the smaller force of the Kuroshiwo, passes to Japan and returns across North America.

The descending branch of the Pacific circuit, and the ascending branch of the Atlantic circuit, are quite near to each other, and are animated by opposing velocities. They are liable in their respective fluctuations to come into contact and to realize conditions favorable to the formation of the terrible cyclones which infest the coasts of the Antilles, of Florida, etc. The invariable direction of the gyratory motion of these storms is precisely that which would result from the joint rotation produced by two currents in juxtaposition, and propelled by opposing velocities; this confirms the hypothesis which we have accepted as the explanation of gyratory motions.

The north of Asia is outside of these two circuits; there "high pressures and prolonged calms prevail." To the south of its mountain barrier extends the region of the monsoons. In the polar regions, finally, the air has no general motion in any direction.

Without entering into any new details in regard to the Southern Hemisphere, we see quite well how nearly these views approach the reality; the resemblance is improved by the author's remarks as to the rôle of the mountains and the coasts, as to the general movement from north to south, and from south to north during the course of the year, and as to the bifurcations of the currents which enable the two circuits to partially separate at the north in order to surround the polar regions with a continuous current from the west.

If we consider the almost total absence of documents at the time of M. de Tastes's first publications,[4] we can not fail to recognize that he was the first to point out the great importance of the regions of calms and of high pressures and the rôle played by the warm ocean currents in the determination of the aerial currents.[5] Since that time numerous works, both in France and in foreign countries, those in particular of M. Teisserenc de Bort, have completed the study of the regions of high pressure and have shown that the idea of M. de Tastes relates more especially to the winter season. In summer it is no longer the ocean currents which enjoy the high temperatures, but the continental regions. As the part played by the ocean currents is rather conjectured than proved in the memoir of M. de Tastes, his fundamental idea in regard to the beds of the aerial currents has not yet been confirmed. To the areas of high pressure, whose immobility make them recognizable on the charts of means, M. Teisserenc de Bort added as the "great centers of action of the atmosphere" the centers of low pressure; these are only an illusion on the charts of mean values, resulting from the fact that, notwithstanding the fluctuations of their edges, the aerial currents always pass by certain regions, such as the neighborhood of Iceland, where there is no compensation. The charts of means are similar to the daily maps in the regions of high pressure; they differ, however, entirely in the regions of low pressure, and this greatly diminishes our interest in them. In order that this analogy should be maintained in general, it would be necessary to combine together only similar conditions which would constitute types of temperature like those collated by M. Teisserenc de Bort for rigorous winters.

This important idea of the beds of aerial currents was, however, adopted in the lectures of M. Duclaux at the Agricul-

[3] Annales Bureau Centrale de Météorologie de France, Tome IV, 1879, Météorologie Générale, pp. 1–18.

[4] Comptes Rendus, 1865, 1870, 1872, 1874; Soc. Météor., 1874–75; Cong. de Météor., Poitiers, 1874; Congrès International, 1878.

[5] Brillouin apparently refers to the paucity of meteorological memoirs in France. All of these meteorological phenomena had been matters of everyday familiarity in America since the publication of Buchan's isobars in 1869 and the daily maps of the Weather Bureau in 1870. Ferrel's important works attracted no attention in Germany until 1874, and in France at a still later date. They had, however, been mentioned with high appreciation by the present Editor in the circular "On the practical use of daily weather maps," published anonymously by the Chief Signal Officer in April, 1871.—[C. A.

tural Institute, and was eventually very much transformed and completed, as shown by his lectures, published in 1891.[6]

Renouncing the excessive simplification (which, however, was useful in its day) which caused M. de Tastes to look at the total thickness of the atmosphere as being mobile on the whole, M. Duclaux finds in a happy combination of the equatorial circulation of Hadley with the temperate circulation of M. de Tastes, the justification of the rôle of the Gulf Stream in the formation of the horizontal circuit of the temperate regions (Chap. XIX, p. 276). He then defines the manner in which the current encroaches upon the region of high pressure, or "isle of calms" (Chap. XX, p. 310), and, especially, he introduces the explanation (new as well as correct) of those conditions, which are shown on the isobaric charts as X-shaped isobars, and which some meteorologists study only by halves, under the name of V-shaped depressions. This form, which reminds one of the typographic trace of a neck between two mountains, corresponds to the overlapping of two layers of current in the "isle of calms" (page 312). "The presence in the atmosphere of layers of different temperature and animated by different velocities appears to be very common and has been observed in all aeronautic ascensions." It is to these currents halfway up in the atmosphere that are due the hailstorms of spring and the majority of thunderstorms (Chap. XX, pp. 312–322, and Chap. XXII, pp. 353–363). Nothing is clearer and more precise than his descriptions of the various atmospheric conditions, their characteristics and their results.

Finally, I will close by the following remark, which I have insisted upon in my lectures at the Agricultural Institute, as supplementary to those of 1891 to 1896 by M. Duclaux: At the surface of the earth every belt of low pressure is necessarily occupied, not by one current, but by two opposed and contiguous currents. As long as the wind is not very strong, each of these has high pressures on its right in the Northern Hemisphere. Either of these currents, or even both, may be continuous with the areas of high pressures on their borders, or on the other hand be entirely distinct from them. The chart of theoretical atmospheric currents to which this remark refers differs in some interesting particulars from that of M. de Tastes.

The necessity of studying the earth as it really is and not as an ideal uniform globe appears in numerous articles of various degrees of importance published by our naval officers and our French engineers. I will cite a single example:

The Revue Maritime et Coloniale published in 1894 an extensive memoir by M. Duponchel, who does not appear to have been acquainted either with the memoirs of M. de Tastes or with the work of M. Duclaux. M. Duponchel, whose first note on this subject was written in 1889, seems to have arrived independently at views quite similar to those of M. de Tastes, views which he has explained with his usual vigor in a pamphlet of 1892 and in various articles in the Revue des cours scientifiques.

But notwithstanding some ingenious considerations, these memoirs do not add anything to that of M. de Tastes; neither do they add anything to M. Duclaux' work. None of the criticisms of M. Duponchel's views made by naval Lieutenant Tournier[7] apply to the exposition of M. Duclaux.

Without entering into further details, two words will suffice to put the reader on his guard against mixed (theoretical and observational) memoirs.

The influence of the continents and oceans in our Northern Hemisphere—the only one which is well known—is so overwhelming that there is no reason to admit the slightest resemblance between the distribution of pressure and temperature deduced from observations by taking the means by parallels of latitude and the distributions that the same astronomical conditions would produce upon a truly uniform globe. As to the mean wind of the temperate regions—what can it be?

There is, therefore, no reason to attribute a closer relation between scientific facts and the results of those authors who, like Ferrel and Möller, make partial use of these average data, than between the results of those in which a purely theoretical point of view prevails. As regards these latter, we must not judge them from the more or less complete agreement of their results with the said means of observations, but solely according to the rigor of their mechanical and thermodynamic reasoning, and from this point of view no memoir can compare with that by von Helmholtz. He seems to me to have exhausted the subject that he treats of "The circulation of a dry, gaseous atmosphere upon a polished globe, revolving like the earth."

But this is not the last stage; we must find a rigorous treatment of the problem proposed by M. de Tastes, that of the atmospheric circulation upon the earth as it really is—at least in its general features. In attacking this directly, M. de Tastes has been forced to be content with rather vague considerations. To-day the instrument of attack has been forged by von Helmholtz; the principles of the mechanics of the atmosphere, the part played by the mixtures and that played by the resistance of the ground have all been clearly analyzed. It therefore seems that we need only to make known these principles in order to quickly stimulate purely theoretical studies, the comparison of which with observed types—not with averages—may be reasonable. This is the only method of discovering whether all the important elements have really been taken into consideration. It is for these reasons that the publication of the principal theoretical memoirs on the general circulation of the atmosphere at the surface of a uniform globe has seemed to me to be opportune.

[6] Cours de physique et de Météorologie professé à l'Institut agronomique. Hermann, 8 rue de la Sorbonne, Paris.

[7] Revue marit. et colon., October, 1894.

CLIMATOLOGICAL DATA FOR JAMAICA.

Through the kindness of Mr. Maxwell Hall, the following data are offered to the MONTHLY WEATHER REVIEW in advance of the publication of the regular monthly weather report for Jamaica:

Jamaica, W. I., climatological data, July, 1901.

	Negril Point Lighthouse.	Morant Point Lighthouse.
Latitude (north)	18° 15′	17° 55′
Longitude (west)	78° 23′	76° 10′
Elevation (feet)	33	8
Mean barometer, 7 a. m.	29.901	29.901
Mean barometer, 3 p. m.	29.878	29.870
Mean temperature, 7 a. m	79.2	....
Mean temperature, 3 p. m	84.1	....
Mean of maxima	87.6	....
Mean of minima	74.2	....
Highest maximum	92.0	....
Lowest minimum	72.0	....
Mean dew-point, 7 a. m	74.2	....
Mean dew-point, 3 p. m	76.2	....
Mean relative humidity, 7 a. m.	84.0	....
Mean relative humidity, 3 p. m.	77.0	....
Total rainfall (inches)	3.16	4.44
Average wind direction, 7 a. m	var.	var.
Average wind direction, 3 p. m	var.	var.
Average hourly velocity, miles, 7 a. m	7.5	8.2
Average hourly velocity, miles, 3 p. m	11.6	11.9
Average cloudiness (tenths):		
7 a. m. Lower clouds	0.1	2.2
7 a. m. Middle clouds	1.6	1.8
7 a. m. Upper clouds	4.4	1.0
3 p. m. Lower clouds	2.7	1.8
3 p. m. Middle clouds	5.3	2.0
3 p. m. Upper clouds	0.7	1.2

NOTE.—The pressures are reduced to standard temperature and gravity, to the Kew standard, and to mean sea level. The thermometers are exposed in Stevenson screens.

Comparative table of rainfall for each geographical division.

Divisions.	Relative area.	Number of available stations.	Rainfall.	
			Average for May.	Current for May, 1901.
Northeastern division	25	21	6.20	7.70
Northern and subcentral division	22	54	3.19	7.23
Western-central division	26	26	8.25	10.19
Southern division	27	33	4.38	5.25
General means	....	....	5.51	7.59

In taking the average rainfall Mr. Hall uses only those stations for which he has several years of observation, so that the column of averages represents fairly well the normal rainfall for each division, while the column for the current month represents the average rainfall at those same stations. The relative areas of the divisions are very nearly the same and are given in the preceding table as expressed in percentages of the total area of Jamaica. The number of rainfall stations utilized in each area varies slightly from month to month, according as returns have come in promptly or not, but will not differ greatly from the numbers in the second column of the table.

CLIMATOLOGY OF COSTA RICA.

Communicated by H. PITTIER, Director, Physical Geographic Institute.

TABLE 1.—*Hourly observations at the Observatory, San Jose de Costa Rica, during July*, 1901.

Hours.	Pressure.		Temperature.		Relative humidity.		Rainfall.		
	Observed, 1901.	Normal, 1889-1900.	Observed, 1901.	Normal, 1889-1900.	Observed, 1901.	Normal, 1889-1900.	Observed, 1901.	Normal, 1889-1900.	Duration, 1901.
	660+ *Mm.*	660+ *Mm.*	° *C.*	° *C.*	%	%	*Mm.*	*Mm.*	*Hrs.*
1 a. m	3.46	3.70	17.08	17.65	95	91	1.0	1.1	1.49
2 a. m	3.11	3.32	16.75	17.51	95	90	0.1	1.2	0.17
3 a. m	2.95	3.08	16.50	17.11	94	91	0.0	2.5	0.00
4 a. m	2.76	2.98	16.40	17.15	93	91	0.0	1.3	0.00
5 a. m	2.83	3.10	16.25	17.04	93	91	0.0	0.4	0.00
6 a. m	3.00	3.37	16.24	17.00	93	91	0.2	0.5	1.00
7 a. m	3.37	3.76	17.79	18.23	89	87	0.0	0.6	0.00
8 a. m	3.63	3.97	19.77	20.07	80	80	0.0	0.7	0.00
9 a. m	3.86	4.15	21.84	21.64	72	75	0.0	1.2	0.00
10 a. m	3.93	4.13	23.65	22.95	68	70	0.0	0.8	0.00
11 a. m	3.76	4.04	24.08	23.71	69	69	0.0	1.4	0.00
12 m	3.58	3.75	24.40	24.29	70	69	0.0	4.9	0.00
1 p. m	3.14	3.35	23.36	24.11	74	69	8.4	14.8	1.00
2 p. m	2.90	2.94	22.35	23.50	79	73	22.7	19.0	6.68
3 p. m	2.58	2.68	21.45	22.50	83	76	19.3	23.7	7.91
4 p. m	2.52	2.63	20.66	21.45	86	80	53.2	36.9	10.15
5 p. m	2.72	2.83	19.75	20.53	90	83	68.7	34.9	10.88
6 p. m	3.01	3.12	19.05	19.70	92	86	74.7	37.9	11.12
7 p. m	3.37	3.55	18.64	19.04	94	89	48.5	20.7	11.83
8 p. m	3.68	3.97	18.35	18.69	95	89	44.0	13.8	11.67
9 p. m	3.93	4.20	18.09	18.44	95	90	17.3	7.8	7.92
10 p. m	4.10	4.36	17.93	18.16	95	90	15.4	5.6	5.67
11 p. m	4.08	4.35	17.66	17.96	95	90	4.0	2.9	3.08
Midnight	3.86	3.93	17.43	17.81	95	91	4.4	1.8	2.51
Mean	663.34	663.56	19.39	19.85	87	84	......	......	......
Minimum	661.10	659.83	14.4	13.2	51	32	......	......	......
Maximum	665.50	666.42	28.0	29.2	100	100	74.7	37.9	......
Total	......	......	......	......	......	......	398.0	241.0	93.08

REMARKS.—The barometer is 1,169 meters above sea level. Readings are corrected for gravity, temperature, and instrumental error. The dry and wet bulb thermometers are 1.5 meters above ground and corrected for instrumental errors. The hourly readings for pressure, wet and dry bulb thermometers, are obtained by means of Richard registering instruments, checked by direct observations every three hours from 7 a. m. to 10 p. m. The hourly rainfall is as given by Hottinger's self-register, checked once a day. The standard rain gage is 1.5 meters above ground. In the Costa Rican system the San Jose local time is used, which is 0^{h} 36^{m} 13 3^{s} slower than seventy-fifth meridian time.

TABLE 2.

Time.	Sunshine.		Cloudiness observed, 1901.	Temperature of the soil at depth of—				
	Observed, 1901.	Normal, 1889-1900.		0.15 *m.*	0.30 *m.*	0.60 *m.*	1.20 *m.*	3.00 *m.*
	Hours.	*Hours.*	%	° *C.*	° *C.*	° *C.*	° *C.*	° *C.*
7 a. m	11.72	8.18	70	21.13	21.52	22.20	21.99	21.64
8 a. m	18.89	15.97	......	......	......	......	......	......
9 a. m	24.69	16.42	......	......	......	......	......	......
10 a. m	22.16	15.42	70	21.45	21.58	22.23	22.01	......
11 a. m	16.97	14.94	......	......	......	......	......	......
12 m	13.29	10.32	......	......	......	......	......	......
1 p. m	5.30	9.65	89	21.91	21.70	22.24	22.00	......
2 p. m	4.83	8.84	......	......	......	......	......	......
3 p. m	2.67	7.58	......	......	......	......	......	......
4 p. m	3.42	5.17	96	21.92	21.77	22.19	21.97	......
5 p. m	0.48	3.19	......	......	......	......	......	......
6 p. m	0.00	1.02	......	......	......	......	......	......
7 p. m	......	......	97	21.81	21.71	22.18	21.96	......
8 p. m	......	......	......	......	......	......	......	......
9 p. m	......	......	......	......	......	......	......	......
10 p. m	......	......	77	21.64	21.68	22.18	21.96	......
11 p. m	......	......	......	......	......	......	......	......
Midnight	......	......	......	......	......	......	......	......
Mean	......	......	82	21.66	21.66	22.20	21.98	21.64
Total	124.42	118.52	......	......	......	......	......	......

Notes on the weather.—This month has been characterized on the Pacific slope by two periods of daily and generally heavy rainfall, separated by three days, 13th, 14th, 15th, of fair weather (veranillo); in San José the heaviest showers fell on the 2d and 29th, with 46 and 54 millimeters in 5 and 2 hours, respectively; the temperature was about normal for the season, the mornings being generally clear and bright (only two days without sun). On the Atlantic coast belt the drought continued, while heavy rainfall was reported from the interior.

Earthquakes.—July 11, 9^{h} 31^{m} p. m., slight shock, N–S, intensity II, duration 3 seconds; July 13, 8^{h} 28^{m} a. m., light shock, NNW–SSE, intensity II, duration 2 seconds; July 23, 9^{h} 43^{m} 30^{s} p. m., heavy shock, W–E, intensity III, duration 20 seconds; July 25, 2^{h} 40^{m} p. m., heavy shock, WNW–ESE, intensity III, duration 17 seconds; July 25, 7^{h} 1^{m} p. m., light tremors, N–S, intensity II, duration 5 seconds.

TABLE 3.—*Rainfall at stations in Costa Rica, July*, 1901.

Stations.	Amount.	No. rainy days.	Stations.	Amount.	No. rainy days.
	Mm.			*Mm.*	
1. Sipurio (Talamanca)	287	20	14. Juan Vinas	111	31
2. Boca Banano	141	14	15. Santiago	290	22
3. Limon	129	8	16 Paraiso	88	23
4. Swamp Mouth	128	6	17. Las Concavas	......	......
5. Zent	......	......	18. Cartago	......	......
6. Gute Hoffnung	275	14	19. Tres Rios	473	27
7. Siquirres	303	16	20. S. Francisco G	407	25
8. Guapiles	138	17	21. San Jose	398	24
9. Sarapiqui	......	......	22. La Verbena	415	27
10. San Carlos	332	26	23. Alajuela	466	25
11. Las Lomas	380	16	24. San Isidro Alajuela	549	27
12. Peralta	273	23	25. Nuestro Amo	369	29
13. Turrialba	291	22			

MEXICAN CLIMATOLOGICAL DATA.

Through the kind cooperation of Señor Manuel E. Pastrana, Director of the Central Meteorologic-Magnetic Observatory, the monthly summaries of Mexican data are now communicated in manuscript, in advance of their publication in the Boletin Mensual. An abstract, translated into English measures, is here given, in continuation of the similar tables published in the MONTHLY WEATHER REVIEW since 1896. The barometric means are now reduced to standard gravity.

Mexican data for July, 1901.

Stations.	Altitude.	Mean barometer.*	Temperature.			Relative humidity.	Precipitation.	Prevailing direction.	
			Max.	Min.	Mean.			Wind.	Cloud.
	Feet.	*Inch.*	° *F.*	° *F.*	° *F.*	%	*Inch.*		
Culiacan Ros. (Sin.)..	112	29.60	104.0	77.8	87.4	70	5.22	ssw.,sw.	ne.
Durango (Seminario)	6,243	23.94	102.7	51.8	71.8	54	1.78	ese.	e,
Leon (Guanajuato)...	5,906	24.21	88.3	56.3	70.2	67	3.18	se,	e.
Linares (Nuevo Leon).	1,188	28.60	96.8	68.0	81.9	72	1.38	s.	s.
Mazatlan	25	29.79	89.2	75.0	82.8	78	13.46	nw.	e.
Mexico (Obs. Cent.)..	7,472	22.99	76.1	52.7	62.2	72	6.90	n.	....
Morelia (Seminario)..	6,401	23.89	76.8	51.6	62.4	82	12.37	se.	e.
Puebla (Col. Cat.)...	7,125	23.32	78.3	53.6	66.0	70	6.52	ene.	ssw.
Saltillo (Col. S. Juan).	5,399	24.73	86.0	59.0	70.7	75	5.47	n.	ne.
S. Isidro (Hac. de Gto)	....	....	78.4	68.0	......	......	4.83	ne,	....
Toluca	8,812	21.91	72.9	36.5	58.5	74	5.94	s.	....

*Reduced to standard temperature and gravity.

SUPPLEMENTARY REMARKS ON THE THEORY OF THE FORMATION OF RAIN ON MOUNTAIN SLOPES.[1]

By Prof. Dr. F. POCKELS.

(1.) Assuming the average vertical distribution of temperature and moisture for each of the four seasons of the year as it is deduced by von Bezold from the scientific balloon ascensions published by Berson and Assmann in their "Ergebnissen," "The results of scientific balloon voyages," there result the following minimum elevations required in order that condensation may begin in a mass of air that was originally at the absolute altitude H above sea level.

H.	Spring-time.	Summer.	Autumn	Winter.
Meters.	*Meters.*	*Meters.*	*Meters.*	*Meters.*
0	725	850	405	400
500	485	710	615	760
1,000	855	570	600	1,070
1,500	890	680	835	1,140
2,000	9 0	730	1,180	1,100
3,000	830	1,060	1,208	1,130
4,000	700	1,125	1,240	1,100

The smallest number in each colums is also the smallest altitude that a mountain ridge must possess in order to cause the formation of clouds under the assumed conditions, but it is only in the case of a very broad mountain ridge that such small altitude will suffice. We see that in the autumn and winter a mountain of about 400 meters in height will suffice to produce a formation of cloud in contact with the summit of the mountain, whereas in spring and summer, the mountain must be higher (namely about 500 or 570 meters respectively), and when the air passes over this mountain the formation of cloud will begin in the layer lying at 500 or 1,000 meters above its summit. These numbers at present serve only as examples; in practice, however, they suggest that as soon as we observe the formation of cloud above a mountain of less altitude than the above given tabular minimum altitude, we may conclude somewhat as to the average moisture at that altitude at that time. We may also remark that on account of the increasing flatness of the lines of flow as the altitude increases, the above given minimum altitudes must be exceeded by so much the more in proportion as the width of the summit ridge is smaller, and the altitude of the layer in which the condensation begins is higher.

(2.) The method developed by me for computing the condensation that occurs on any given mountain slope can not be applied to computing the mean value of the precipitation for any given interval of time, by introducing into the computation the mean values of the temperature and moisture for this interval. We should in this way find too small a precipitation. Thus, for example, the altitude of the mountains might not suffice to cause any condensation at all for the average condition of the air, but could cause it on those occasions when the moisture exceeds its average value, wherefore the average value of the rainfall for the interval of time under consideration would be different from zero. As the variation of the moisture from its average value may cause rainfalls where otherwise there would be none, so also, with the currents of air mechanically forced to ascend mountain ranges, and whose effect is superposed upon that of the general circulation of the air in cyclonic areas; for it can happen that neither one of these two causes may alone suffice to form rain, but that both together do. This explains why elevations of the surface of the earth of from 100 to 200 meters increase the annual mean value of the total precipitation, as for instance, as shown by the charts in Assmann's memoir of 1886, "Einfluss, etc." "On the influence of mountains on the climate of central Germany."

(3.) The examples given in my article show that in so far as condensation in general takes place on the slopes of mountains, its intensity (therefore also, the density of the precipitation when falling vertically) is in general greatest where the slope of the mountain is steepest. If now we consider that in the course of all the various conditions of the atmosphere that may occur in a long interval of time, the first condensation occurs most frequently above the upper portion of the slope, then it follows that the average density of precipitation computed for a long interval of time, must increase, not only with the inclination of the slope, but also with the absolute altitude of the locality under consideration. To this case corresponds the formula for the annual quantity of precipitation expressed in milimeters deduced by Dr. R. Huber in his "Untersuchungen, etc." investigation of the distribution of precipitation in the canton of Basle, namely:

$$N = 793 + 0.414\,h + 381.6 \tan \alpha$$

where h is the altitude in meters, and α indicates the gradient angle. (See A. Riggenbach, Verhandlung der Naturforschenden Gesellschaft. Basel, 1895. Vol. X, p. 425).

(4.) From a comparison of the effects of different broad mountain ranges of the same altitude, it results (see page 474 of my article, or page 157 of the translation in the MONTHLY WEATHER REVIEW) that the smaller, and therefore steeper, mountains always cause a smaller total condensation than the broader and narrower mountain summits. Notwithstanding this, the density of precipitation on the slope of the smaller is generally larger than on the slope of the larger mountains because the smaller total precipitation is distributed over a ground surface that is relatively much smaller yet. In reality, however, this only obtains so long as the quantity of water remaining suspended in the cloud is only a small fraction of the total condensation; in the case of very narrow mountain ridges it will be more apt to happen that a considerable fraction passes on over and beyond the summit and is subsequently again evaporated [and therefore does not appear as rainfall].

(5.) I regret to notice that in the first two figures of my original memoir, as also in the translation, the legend inscribed on the curves representing the distribution of precipitation reads "precipitation in millimeters per second," instead of "per hour," as is correctly stated in the text; the necesary correction should be made.

(6.) A precise test of this theory can not at present be carried out, because we have not sufficient observations of the

[1] The translation of the important memoir by Professor Pockles, of Heidelberg, published on pages 152–159 of the MONTHLY WEATHER REVIEW for April, 1901, was prepared and published quite promptly, without waiting for any subsequent corrections and notes by the author. A modified draft of the original memoir was published in the Meteorologische Zeitschrift for July, 1901, and Professor Pockles now requests that the following additional remarks may be published.

conditions of the upper strata and of the ground along the slope of a given mountain range.

[A special series of observations for this purpose could advantageously be made by means of kites and balloons determining the exact conditions that prevail in the great westerly currents that bring steady rain to the coasts of Oregon and Washington, or in the easterly currents that bring rain to the Atlantic States and the Appalachian Range. The kite work done by the United States Weather Bureau in 1898, in the upper Mississippi watershed and Lake region, affords excellent examples for the application of general theorems of the circulation of the upper atmosphere, but do not happen to illustrate the great problem of the formation of general rains on mountain slopes.—ED.]

MONTHLY STATEMENT OF AVERAGE WEATHER CONDITIONS FOR JULY.

By Prof. E. B. GARRIOTT, U. S. Weather Bureau.

The following statements are based on average weather conditions for July, as determined by long series of observations. As the weather for any given July does not conform strictly to the average conditions, the statements can not be considered as forecasts.

July is usually a quiet month on the North Atlantic Ocean. The storms of the middle latitudes are seldom severe, and the season of tropical hurricanes does not begin until August. July and August are the months of greatest fog frequency near the Banks of Newfoundland, and fog areas will be encountered in that region on fully two-thirds of the days of these months. The fogs of the Grand Banks and those of the steamer tracks to the westward usually occur with winds from the southeast quadrant. The southward movement of Arctic ice over the Banks of Newfoundland continues during July. Iceburgs do not, however, run so far south as during the spring months.

The general storms of the United States commonly originate on the middle-eastern or northeastern slope of the Rocky Mountains and move eastward over the northern Lake region, the St. Lawrence Valley, and Newfoundland without developing marked intensity. In the Pacific coast districts July and August are practically rainless months, and these are the driest months of the year in the middle and northern Plateau regions. In Arizona and New Mexico July and August are the wettest months of the year. From the Rocky Mountains to the Atlantic coast the heaviest monthly rainfalls of the year occur from June to August, and, as a rule, the greater part of the rain falls in showers or thunderstorms of short duration.

The frosts of July are confined, practically, to the northern tier of States and to mountain districts.

HAWAIIAN CLIMATOLOGICAL DATA FOR JULY, 1901.

By CURTIS J. LYONS, Territorial Meteorologist.

Meteorological observations at Honolulu, July, 1900.

The station is at 21° 18′ N., 157° 50′ W.

Hawaiian standard time is 10h 30m slow of Greenwich time. Honolulu local mean time is 10h 31m slow of Greenwich.

Pressure is corrected for temperature and reduced to sea level, and the gravity correction, —0.06, has been applied.

The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 12, or Beaufort scale. Two directions of wind, or values of wind force, or amounts of cloudiness, connected by a dash, indicate change from one to the other.

The rainfall for twenty-four hours is measured at 9 a. m. local, or 7.31 p. m., Greenwich time, on the respective dates.

The rain gage, 8 inches in diameter, is 1 foot above ground. Thermometer, 9 feet above ground. Ground is 43 feet, and the barometer 50 feet above sea level.

Date.	Pressure at sea level.	Temperature.		During twenty-four hours preceding 1 p. m., Greenwich time, or 2.29 a. m., Honolulu time.									Total rainfall at 9 a. m., local time.
				Temperature.		Means.		Wind.		Average cloudiness.	Sea-level pressures.		
		Dry bulb.	Wet bulb.	Maximum.	Minimum.	Dew-point.	Relative humidity.	Prevailing direction.	Force.		Maximum.	Minimum.	
	*	†	†			‡	‡		§				
1	29.92	76	69	84	74	66.8	68	ne.	3	3	29.95	29.90	0.04
2	29.98	76	69	85	74	65.5	64	ne.	3-4	4	30.01	29.98	0.00
3	29.97	77	69.5	83	74	65.0	63	ne.	4-3	5	30.02	29.96	0.00
4	29.94	77	70.5	84	75	67.3	67	ne.	4-5	4	29.98	29.93	0.00
5	29.94	75	69	85	75	67.5	68	ne.	5-4	3-7	29.96	29.90	0.02
6	29.96	69	67.5	84	74	66.7	70	ne.	3-4	6	29.98	29.91	0.01
7	29.98	69	68.3	84	68	68.7	83	sw-n.	1-0	3-9	30.06	29.96	0.42
8	30.01	76	69.5	85	68	68.0	75	ne.	1-3	2	30.04	29.99	0.01
9	29.97	76	68	85	73	65.7	64	ne.	3	3	30.03	29.94	0.00
10	29.95	77	71	85	75	65.0	68	nne.	3-4	3-5	29.99	29.94	0.02
11	30.00	76	68	84	74	67.3	67	ne-nne.	5	4-1	30.03	29.94	0.02
12	29.97	77	67	82	72	64.0	64	ne.	6-5	3-9	30.04	29.96	0.02
13	29.95	75	69	82	75	64.7	63	ne.	4-6	5	30.02	29.93	0.23
14	29.96	77	69	83	72	66.3	67	ne.	4-5	6-3	30.01	29.94	0.01
15	29.95	74	70.5	85	75	66.3	67	ne.	3	3-5	30.00	29.94	0.08
16	29.96	74	68	84	71	67.3	72	ne.	2-4	3	30.02	29.94	0.03
17	29.94	76	68.5	85	73	66.0	66	ne.	3	6	30.00	29.93	0.01
18	29.98	75	68.5	85	74	65.8	63	ne.	3	2	30.01	29.93	0.14
19	29.99	76	72	84	70	66.7	68	ne.	3-5	4	30.03	29.96	0.10
20	30.00	76	71	84	73	70.3	79	ne.	4	4-8	30.06	29.99	0.06
21	29.98	76	69.5	84	73	67.7	69	ne.	4	6-2	30.03	29.96	0.00
22	29.96	75	69	84	74	65.7	64	ne.	3	2	30.01	29.96	0.01
23	29.92	69	67	84	74	66.7	70	ne.	4	6	29.99	29.91	0.01
24	29.89	71	69	84	68	66.0	71	ne.	3	3	29.95	29.89	0.05
25	29.93	68	66.7	80	69	67.5	77	ne.	2-0	6-10	29.96	29.88	0.04
26	29.94	76	68	85	67	66.7	71	ne.	2-3	3	29.99	29.92	0.01
27	29.96	76	69.5	83	74	65.7	64	ne	4	5	29.98	29.91	0.00
28	29.94	76	68	84	75	66.7	71	ne	5-2	5	29.99	29.91	0.05
29	29.95	76	69	84	74	64.7	63	ne.	4-2	3	29.98	29.89	0.01
30	29.94	75	68.5	84	75	64.0	61	ne.	4	4	30.00	29.93	0.01
31	29.94	75	68	83	74	64.0	62	ne.	3-4	8-4	29.99	29.93	0.12
Sums	......	......	......	......	......	......	......	....	......	......	......	......	1.53
Means	29.957	74.7	68.9	83.9	72.7	66.2	68	....	2.7	4.4	30.004	29.933	......
Departure	—0.026	......	......	......	......	+1.1	+1.2	....	......	+0.4	......	......	—0.27

Mean temperature for July, 1901 (6+2+9) ÷ 3=77.8°; normal is 77.3°. Mean pressure for July (9+ 3) ÷ 2 is 29.969; normal is 29.995.

GENERAL SUMMARY FOR JULY, 1901.

Temperature mean for the month, 77.8°; normal, 77.3°; average daily maximum, 83.9°; average daily minimum, 72.7°; average daily range, 11.2°; greatest daily range, 18°; least daily range, 7°; highest temperature, 85°; lowest, 67°.

Barometer average, 29.969; normal, 29.995 (corrected for gravity by —.06); highest, 30.06, on the 19th; lowest, 29.88, on the 24th; greatest 24-hour change, .08. On account of the evenness of pressure, lows and highs were hardly distinguishable; low pressure may be noted on the 4th and 24th, and high on the 11th and 19th. The barometer has been below the normal for four months in succession.

Relative humidity, 68; normal, 66.8; mean dew-point, 66.2°; normal, 65.1°; mean absolute moisture. 7.07 grains to the cubic foot; normal, 6.81.

Rainfall, 1.53 inch; normal, 1.80 inch; rain recorded days, 25; normal, 19; greatest rainfall in one day, 0.42 inch, on the 6th; total at Luakaha, 8.75 inches; at Kapiolani Park, 1.10 inch; at Kalihi-uka, 2.50 inches fell on the 6th. Total rainfall since January 1, 22.94 inches; normal, 20.62 inches.

The artesian well water stands at 33.40 feet above mean sea level at the Punahou well. The average mean sea level for the month stood at 10.42 feet above an assumed base, 9.00 feet being hydrographic zero (low water) and 10.00 feet standard mean sea level.

Trade-wind days, 30 (1 of north-northeast); normal for July, 29; average force, Beaufort scale, 2.7 (16 statute miles per hour). Cloudiness, tenths of sky, 4.4; normal, 4.0. Upper currents of air mostly from the southwest.

Percentages of district rainfall as compared with normal: Hilo, 40 per cent; Hamakua, 17; Kohala, 20; Waimea, 14; Kona, 125; Kau, 50; Puna, —; Maui, probably 100; Oahu, 100; Kauai, 250 to 320. The lack of water in North Hawaii is quite serious.

Mean temperatures: Pepeekeo, Hilo district, 100 feet elevation, average maximum, 78.6°; average minimum, 69.3°. Waimae, Hawaii, 2,730 feet elevation, 77.8° and 65.9°. Kohala, 521 feet elevation, 80.9° and 71.5°. Ewa Mill, Oahu, 50 feet elevation, 86.6 and 69.4. Kulaokahua, W. R. Castle's 60 feet elevation, highest, 87°; lowest, 68; average, 77.9°. The prevailing heat of the Northern Hemisphere has not affected these islands.

No earthquake reported. It is unofficially reported that Kilauea shows fire through its floor. Thunder and lightning on Hawaii on the 18th, and on Oahu on the 19th. Snow fell on Mauna Kea on the 18th. Heavy swell on the 3d, 9th to 14th, and 29th.

On June 30 large quantities of fresh black pumicestone were found floating in the bay at Kealakekua.

The high average level of the sea for the months of June and July has attracted some attention. It is doubtless due to meteorological conditions, perhaps in the South Pacific.

Under date of August 19, 1901, Mr. Lyons says:

> Perhaps you have the means of knowing whether the barometric pressure in the South Pacific and Australia has been higher than usual during the summer months. The unusual height of mean sea level, as determined by our self-recording tide gage has attracted some attention. There is always as you know a change in sea level either at different seasons of the year, or at certain as yet unknown periods, but it has been about 0.3 foot greater than usual this season.

Rainfall data for the Hawaiian Service.

Stations.	Elevation.	July, 1901.	Stations.	Elevation.	July, 1901.
HAWAII.			MAUI—*Continued.*	*Feet.*	*Inches.*
HILO, e. and ne.	*Feet.*	*Inches.*	Hamoa Plantation, se	60	2.76
Waiakea	50	4.76	Nahiku, ne	60	....
Hilo (town)	100	....	Nahiku (Lemmon, ne	990	10.56
Kaumana	1,250	7.19	Haiku, n	700	3.52
Pepeekeo	100	4.97	Kula (Erehwon), n	4,500	1.01
Hakalau	200	4.01	Puuomalei, n	1,400	....
Honohina	300	3.83	Paia, n	180	1.14
Laupahoehoe	500	....	Haleakala Ranch, n	2,000	1.94
Ookala	400	1.45	Wailuku	200	....
HAMAKUA, ne.			LANAI.		
Kukaiau	250	0.70	Keomuku, e	6	....
Paauilo	750	0.85	OAHU.		
Paauhau (Gibb)	300	0.44	Punahou (W. B.), sw	47	1.53
Paauhau (Greig)	1,150	0.50	Kulaokahua, sw	50	0.59
Honokaa (Muir)	425	0.57	Kewalo (King street), sw	15	0.87
Honokaa (Rickard)	1,900	0.30	United States N. S., sw	6	0.48
Kukuihaele	700	0.65	Kapiolani Park, sw	10	1.10
KOHALA, n.			Manoa (Woodlawn Dairy), c	285	5.54
Awini Ranch	1,100	....	Makiki Reservoir	150	1.84
Niulii	200	1.01	School street (B shop), sw	50	1.95
Kohala (Mission)	521	1.37	Pacific Heights, sw	700	4.11
Kohala (Sugar Co.)	235	....	Insane Asylum, sw	30	1.72
Hawi	300	....	Kalihi-uka	260	8 60
Hawi Mill	600	1.47	Nuuanu (W. W. Hall), sw	50	1.43
Waimea	2,720	0.32	Nuuanu (Wyllie street), sw	250	3.09
KONA, w.			Nuuanu (Elec. Station), sw	405	4.22
Kailua	950	6.61	Nuuanu (Luakaha) c	850	8.75
Kealakekua	1,580	8.07	Waimanalo, ne	25	1.20
Napoopoo	25	....	Maunawili, ne	300	4.02
KAU, se.			Kaneohe, ne	100	....
Honuapo	15	0.26	Ahuimanu, ne	350	7.24
Kakuku	1,680	2.78	Kahuku, n	25	2.26
Naalehu	650	1.03	Waialua, n	20	....
Hiloa	310	3.10	Wahiawa, c	900	2.00
Pahala	850	1.21	Ewa Plantation, s	60	0.30
Moaula	1,700	3.17	Waipahu, s	200	0.68
PUNA, e.			Moanalua, sw	15	1.18
Volcano House	4,000	2.80	KAUAI.		
Olaa	......	....	Lihue (Grove Farm), e	200	5.90
Olaa	......	....	Lihue (Molokoa), e	300	6.49
Kapoho	110	....	Lihue (Kukaua), e	1,000	12.36
Kalapana, se	8	....	Kealia, e	15	....
MAUI.			Kilauea, ne	325	9.91
Olowalu	......	....	Hanalei, n	10	11.90
Lahaina	......	....	Waiawa, sw	82	1.83
Waiopae Ranch, s	700	0.00	Eleele, s	200	4.72
Kaupo (Mokulau), s	285	4.85	Waiawa, Mountain, s	2,100	28.25
Kipahulu, s	300	5.68	McBrides (Res.)	850	8.51

Records not hitherto published, June, 1901.

Nuuanu (Wyllie street)	......	3.88	Kahikinui (Maui)	......	0.36
Kula (Erehwon)	......	3.11	Laupahoehoe	......	0.95

NOTE.—The letters n. nw. e. sw. se. ne. and s. attached to each name indicate the exposure or direction toward which localities face; "c," central locality.

RECENT PAPERS BEARING ON METEOROLOGY.

W. F. R. PHILLIPS, in charge of Library, etc.

The subjoined titles have been selected from the contents of the periodicals and serials recently received in the library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau:

American Journal of Science, New Haven, Conn. 4th Series. Vol. 12.

Liveing, G. D. and Dewar, James. On the Separation of the Least Volatile Gases of Atmospheric Air and their Spectra. Pp. 207–215.

Dewar, James. The Nadir of Temperature and allied problems. Pp. 168–172.

Adams, Edwin P. The Electromagnetic Effects of Moving Charged Spheres. Pp. 155–167.

Davis, J. Woodbridge. On the Motion of Compressible Fluids. Pp. 107–114.

Annuaire de la Société Météorologique de France. Tours. 49me année.

Besson, Louis. Mesure de la direction et de la vitesse en ballon. Pp. 163–165.

Besson, Louis. L'ascension internationale du 19 avril, 1901, à Paris. Pp. 161–163.

Lemoine, G. et Maillet, E. Sur le débit probable des sources pendant la saison chaude de 1901, Pp. 159–161.

Ritter, Charles. Le nuage et son rôle dans la production de la pluie. Pp. 137–141.

Annalen der Physik. Leipzig. Vierte folge. Band 5.

Angstrom, K. Ueber die Abhängigkeit der Absorption der Gase, besonders der Kohlensäure. Pp. 163–173.

Kapp, A. W. Studien über das Luftthermometer. Pp. 905–918.

Lemstrom, Selim. Uber das Verhalten der Flüssigkeiten in Capillarröhren unter Einfluss eines elektrischen Luftstromes. Pp. 729–756.

Annales Agronomiques. Paris. Tome 27.

Charabot, —. Influences simultanées séparées de la lumière, de l'altitude, de l'état hygrométrique, de la température, sur la croissance des végétaux. P. 383.

Annalen der Hydrographie und Maritimem Meteorologie. 29 *Jahrg.*

Knipping, E. Sturmtabellen für den Atlantischen Ozean. Beiheft I. P. 19.

Archives des Sciences Physiques et Naturelles. Genève. Tome 12.

Finsterwalder, S. et Muret, E. Les variations périodiques des glaciers. 6me rapport. 1900. Rédigé au nom de la Commission internationale des glaciers. Pp. 118–132.

Ebert, Hermann. Sur les ions libres de l'air atmosphérique. Pp. 97–118.

Forel. F. A. Étude thermique des lacs du nord de l'Europe. Pp. 35–55.

Ciel et Terre. Bruxelles. 22me année.

—. Hauteur des nuages. P. 280.

V. D. L. La pluie de poussière des 10 et 11 mars, 1901. P. 257–262.

Lancaster, A. La température [1833–1892 à Bruxelles, 1893–1900 à Uccle]. Pp. 249–251.

Linden, E. Vander. Pluie dans un anticyclone. Pp. 229–233.

Rahir, E. Photographies du brouillard. Pp. 295–296.

Comptes Rendus. Paris. Tome 133.

Cosserat, Eugene et Francois. Sur la déformation infiniment petite d'une enveloppe sphérique. Pp. 326–329.

Stanoiewitch, G. M. Méthode électro-sonore pour combattre la grêle. Pp. 373–374.

Das Wetter. Braunschweig. 18 *Jahrg.*

Assmann, [Richard]. Die Hitze und Dürre des diesjahrigen Sommers in Deutschland. Pp. 161–168.

Electrical World, New York. Vol. 38.

Reichel, Walter. [Air Resistance to Rapidly Moving bodies; in article] Zossen Polyphase Railway Experimental Trials with Speeds up to 125 Miles per Hour. Pp. 367–372.

Gaea. Leipzig. 37 *Jahrg.*

Klein, Hermann. Die Erforschung der Atmosphäre und deren Bedeutung. Pp. 513–527.

Geographical Journal. London. Vol. 18.

Cornish, Vaugham. On Sand-Waves in Tidal Currents. Pp. 170–202.

National Geographical Magazine. New York. Vol. 12.

Page, James. The Drift of Floating Bottles in the Pacific Ocean. Pp. 337–339.

Nature. London. Vol. 64.
MacDowall, Alexander B. The Moon and Wet Days. Pp. 424-425.
La Nature. Paris. 29me Année.
Espitallier, —. Le [balon] dirigeable de M. Santos-Dumont. P. 182.
Proceedings of the Royal Society. London. Vol. 68.
Dewar, James. The Nadir of Temperature and Allied Problems. Pp. 360-366.
Physical Review. London. Vol. 13.
Barnes, H. C. On the Density of Ice. Pp. 55-59.
Davis, Bergen. On a newly Discovered Phenomenon produced by Stationary Sound Waves. Pp. 31-47.
Symons' Meteorological Magazine. London. Vol. 36.
—. London Thunderstorm of July 25. Pp. 109-112.
Dines, W. H. On a Fallacy as to the Diurnal Barometer Wave. Pp. 93-95.
Scientific American Supplement. New York. Vol. 52.
Henry, A. J. Amplification of Weather Forecasts. P. 2146.
Scientific American. New York. Vol. 85.
—. Nemethy's Flying Machine. P. 72.
—. Humidity and Heating Systems. P. 98.
Terrestrial Magnetism and Atmospheric Electricity. Baltimore. Vol. 6.
Bauer, L. A. Note on the Secular Motion of the Earth's Mean Magnetic Axis. P. 73.
Neumayer, G. Mean Secular Change of the Magnetic Declination for the Epoch, 1890-1900. P. 62.
Cady, W. G. Wild's New Method for Determining the Variations of Magnetic Inclination. Pp. 63-64.
— Notes on Atmospheric Electricity. P. 82-84.
— Rainfall Traditions. Pp. 112-113.
Memorias y Revista de la Sociedad Cientifica "Antonio Alzate," Mexico. Tomo 15.
Moreno y Andra. Contribution à l'étude climatologique de la vallée de Mexico. La variabilité interdiurne moyenne de la température à Tacubaya. Pp. 201-219.

YUKON WEATHER.

By U. G. MYERS, Section Director, Eagle, Alaska, dated June 20, 1901.

While temperature is the chief element in any climate, it becomes more dominant as the poles are approached, the other elements becoming more and more subordinated in relative importance.

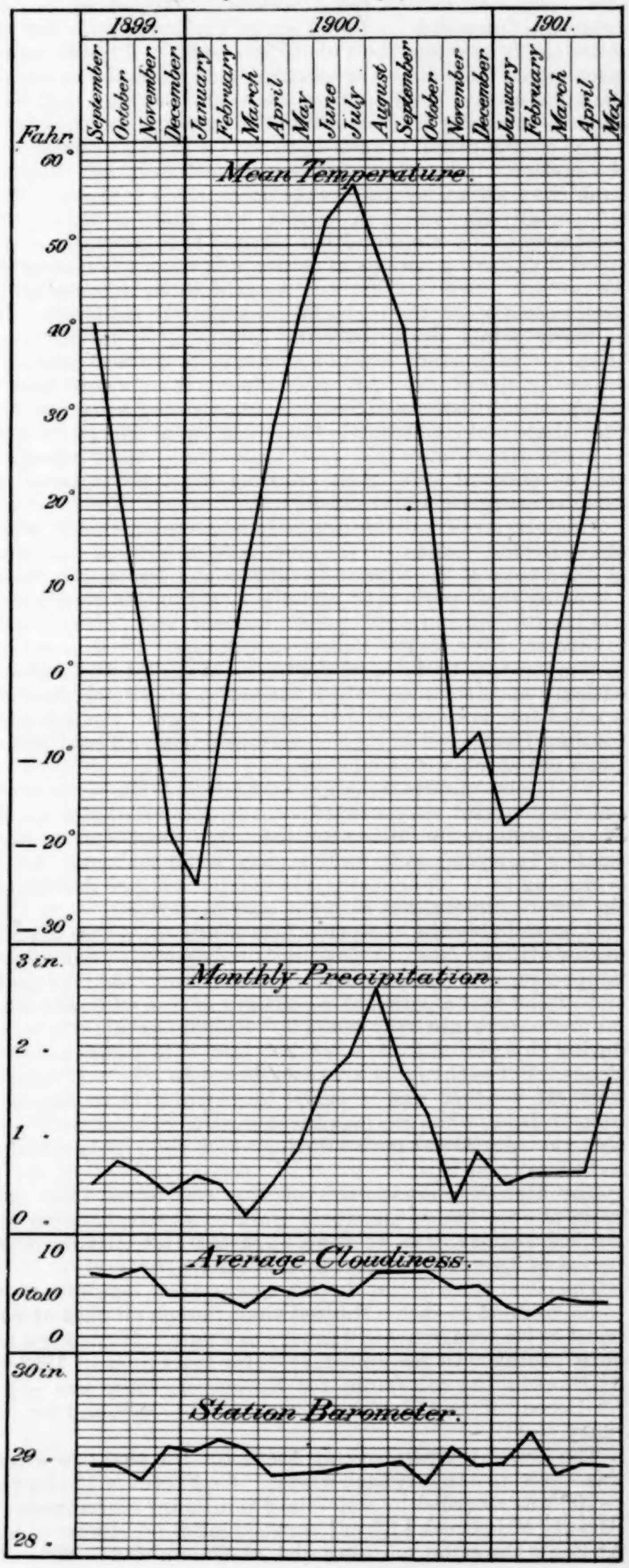
Though Siberia stands first in producing low temperatures, interior Alaska has always been considered a creditable second. In point of occupation the contrast is more marked. While not so cold and easier of access interior Alaska has never been turned to man's account as has been Siberia, but has remained practically an unknown heritage of the aborigines.

Isolated from the States and further shut off from occupation by vague rumors of frightful winter cold, overpowering summer heat, swarms of hungry mosquitoes, fever fuming bogs, etc., the exploitation of the interior seemed fated to await that motive which inspires men to undertakings otherwise insurmountable. Interior Alaska will date her substantial development from the day Henderson met Carmack at the junction of the Klondike and the Yukon rather than from the discoveries of the man who gave his name to the strait and sea of Bering.

While observations at Eagle, owing to their short duration, do not furnish us a safe guide to the climate, they do serve to bring to view important meteorological features of this section; and at the same time eliminate the personal equation from many "personal recollections." The sign of this annoying human element in its relation to weather features here seems always to have been plus during the summer season not only as regards temperature, but mosquitoes also, and just as readily changed to minus along with the temperature.

The town of Eagle is situated in latitude 64° 46′ north, longitude 141° 12′ east. Its location, in a natural amphitheater, 5 to 7 miles across, is peculiarly favorable to local radiation in winter, and to the observation of clouds formed by ascending currents during the warmer months. The clouds formed over the surrounding mountains tend to converge overhead, and all changes to which they are subjected are readily observed.

Meteorological record at Eagle, Alaska.



For many miles on all sides surrounding this place, so far as can be learned, the topography is practically the same,—one succession of hills and mountains with deep and generally contracted valleys lying between. The nearest notable departure from this is found in going down the river 160 miles to Circle where the Yukon flats begin. Here the mountains recede from the river on either side for many miles, and the main stream is cut up into many smaller ones that shift about continually in their sandy beds among the islands.

The configuration is such as to have a marked influence on the surface winds, and anywhere immediately on the river bank the river valley itself is the dominating influence. This is especially noticeable in winter; and more so during the most severe cold than at other times. It is generally understood that during periods of severe cold the air is motionless. Away from the river this may be said to be universally the case, except when the temperature begins to moderate. But at many points along the river (meaning on the ice itself) fresh to brisk winds are not uncommon during periods of lowest temperature. At one moment these winds may be sweeping down stream driving the snow along when suddenly they abate and immediately blow with equal energy from the opposite direction. Only brief exposure to such conditions can be endured; and then clothing must be suitable and exercise energetic and constant.

This blustery condition seems to be confined chiefly within the immediate banks of the river, and is felt less on the top of the banks at the edge and still less and less as you recede.

During these periods of turbulent cold on the river the air has been found to be 20° to 30° warmer, and perfectly calm toward the tops of the higher mountains. Of this increase in temperature there is no doubt, for it can be detected even without an instrument when the valley of a creek, having a marked fall, is ascended with dispatch; but of the prevailing freedom from wind at high elevations during all cold periods I can not speak with confidence.

While the observations are meager and the accuracy of some is doubtful, they seem to point strongly toward a reversal of temperature conditions between this place and adjacent smaller valleys as early as February, when the sun's rays are beginning to be appreciable, the smaller valleys then having the lower temperatures as is the case in summer.

It is probably the exception here if any month in any year passes without frost, or freezing temperature. The highest temperatures of the year occur between June 15 and July 15, and extend over a period of seven days or less, when the maximum temperature may reach 90° or even more. It is only during this period that a few hot and sultry days are experienced, but such nights are never had. In 1898 and 1899 the warmest weather was in early July; in 1900, in the latter part of June, when the maximum rose to 87°. This is probably the only 30-day period during which the nights are likely to be free from frost.

The highest temperatures of the year, seem, from three years of observation and from common report, to occur with marked regularity as to time, apparently oscillating over a period of less than twenty days, from year to year.

The occurrence of the lowest temperature would not seem to be confined to such a limited time, though all data at hand point to its occurrence in January as a rule. It occurred here quite probably in November, 1898, for the winter of 1898-'99. At Dawson the minimum for November, 1898, was —40°; for December, —41°; for January, 1899, —45°, and for February, —41°.

The lowest temperature at Eagle for the past two winters was —68° in January each winter. On February 12 this year, —70° was recorded by a standard minimum thermometer on Seventy Mile Creek [River], some 30 miles northwest of here. At Eagle the same morning the minimum was —65°. The highest minimum since opening the station here was 55° on June 26, 1900; the lowest maximum, —62° on January 14, 1901.

The two years of observation here show a marked variation in the spring rise of temperature. While during all years a marked rise may be expected about the middle of March its progress is not always continuous with the season. The mean temperature for the three months, March, April, and May, 1900, was 28°; for the same period in 1900 it was 21°. The difference in the amount of snow on the ground was more noticeable: On March 31, 1900, it was 0.2 inch; on April 10, 1900, it was trace; on March 31, 1901, it was 22.0 inches, on April 10, 1900, it was trace; on March 31, 1901, it was 22.0 inches; and on April 10, 1901, it was 23.0 inches, though the total depth for 1901 exceeded that for 1900 by less than 6 inches. From common report this variation has even been more decided, as for instance in the spring[1] the Yukon ice did not break up until May 26. During this year unusually bright and warm weather was experienced in the latter part of March and during April only to be succeeded by unseasonably cold and harsh conditions, snowstorms continuing into July.

Even more striking are the temperature anomalies of winter. In December, 1898, after experiencing some of the lowest temperatures of the winter in November, the temperature rose to 40°, and light showers of rain were general throughout the upper Yukon Valley. No such rise is known to have occurred during the winter of 1899-1900, though the maximum temperature was above freezing several days in late October. In February of the present year, a decided rise occurred on the middle and lower Yukon. At Eagle the maximum rose to 28°; at Fort Yukon, to the northwest and 260 miles farther down stream, the temperature went above freezing and a sprinkle of rain fell on one day; at Rampart, some 600 miles down the river from Eagle, the temperature rose to 40° and heavy showers of rain fell on five different days; at Holy Cross Mission, in the lower valley, the temperature rose to 41° and moderately heavy rains fell on three different days. Similar temperature conditions are known to have prevailed at St. Michael, 21° west of this place. No data are available to determine the extent north and south from the Yukon Valley, but in covering this distance of longitude the river ranges over 5° of latitude.

As is to be expected at inland places so far north the precipitation is relatively light and of marked intensity in certain localities only. The annual fall is in the neighborhood of 12 inches, 75 per cent of which falls during the six months of April, May, June, July, August, and September in the form of rain. The heaviest monthly fall seems to occur regularly in August, diminishing with the same rapidity with the approach of cold weather in the fall as it increases with the coming of warm weather in the spring.

While the writer in his experience has never observed any excessive rainfalls it would seem probable that the same occur in certain localities. Seventy Mile Creek [River], entering the Yukon 20 miles below Eagle, is at times suddenly and without warning raised 8 to 10 feet above its ordinary stage in as many hours almost entirely from rains at its headwaters. The watershed at its head while steep is not extensive.

The snowfall at this elevation is not heavy, averaging between 3 and 3.5 feet each winter, and is distributed more or less uniformly over the different months. No single fall here has reached five inches, the average of the heaviest falls being about three inches.

Here, as usual, the precipitation increases with the altitude, and at an elevation of 2,000 feet the snowfall increases 50 per cent or more.

[1] So in the original type-written manuscript. Evidently the year was accidently omitted by Mr. Myers, the date was "within the past decade."—A., ED.]

The depth of snow on ground gradually increases during winter, reaching its maximum depth just previous to the spring rise of temperature. With a combination of favorable conditions its disappearance is rapid. In March, 1900, the first warm day, combined with brisk to high south winds and low relative humidity, decreased the depth from 20.7 inches to 10 inches. In the present year a similar thaw did not occur until a month later and was also not so rapid.

The lowest relative humidity is during May when the air is warming rapidly, and the highest during the coldest month of winter, the fluctuations of the absolute humidity are opposite to this though the highest does not occur with the lowest relative humidity but later in the summer.

The coldest weather is freest from cloud though the coldest month does not show the lowest average cloudiness, the latter occurring in February or March. In February of the present year, during a period of four consecutive days, not a vestige of cloud, fog, haze, or smoke was observed at any time. At this same time, considering a period of seven consecutive days, five of them were perfectly cloudless, and a single small cumulus cloud observed on each of the others.

In the coldest weather where considerable smoke is discharged into the air, as from a town, a heavy dark gray veil is formed having the appearance of fog and smoke mingled. This veil is dissipated by the slightest breath of air, and is consequently more prominent during morning and evening than at other times.

Cloudiness increases as the summer comes on and perfectly cloudless days are rare. Then only a few hours of sunshine are necessary to supply the water vapor and set ascending currents in motion when heavy cumuli form over the surrounding mountains, often producing thunderstorms and local showers. Toward evening, as the atmosphere becomes more quiet, the clouds settle down and to a marked extent pass away. This is repeated almost daily during June, July, and August.

Considering the wind direction here as deduced from two daily observations, 8 a. m. and 8 p. m., local time, for 638 consecutive days, we find west is the prevailing direction with 17 per cent of total times observed. This is followed closely by southeast, 16 per cent; northeast, 15 per cent; east, 14 per cent; northwest, 13 per cent, and calms 10 per cent. The percentage of calms is high, and these are practically all observed during the coldest periods of winter. The diurnal variation of direction is well defined, being from an easterly quarter during the day and westerly during night. In point of number of miles probably more blow from the northeast than from any other direction.

Considering the year 1900 the greatest mean hourly velocity was from 1 to 2 p. m., averaging 6.7 miles; the least was from 5 to 6 a. m., averaging 3.8 miles. High winds are the exception and no gales have yet been recorded; the extreme velocity during the entire period of observation has been 35 miles. On the other hand calms are numerous; no less than three days are on record during which not a single mile was recorded, and four days on which one mile was recorded as the total daily movement.

Observations of soil temperature made in 1900 in cultivated soil, a mixture of humus and clay, show the maximum temperature, at a depth of six inches, to have been 60°. This was reached the first of July or immediately following the maximum air temperature. At this depth the fluctuations followed closely those of the air temperature. At a depth of two feet, the thermometer bulb being in clay alone, the rise was unbroken from 38° in early June to a maximum of 50.5°. On July 27, 50° was reached, and from this time, including August 13, the oscillation was 0.5°; following the latter date the seasonal fall was uninterrupted, dropping to 42° on September 30 when observations ceased.

The monthly averages of the radiation minimum thermometer, 1 foot above cultivated ground, differed from the 8 a. m. station minimum as follows: For June, 2.6° lower; for July, 2.1° lower; for August, 2.6° lower; and for September, 2.6° lower.

Some mention must be made of the Yukon River, the natural highway of interior Alaska both summer and winter. Both the opening and closing of this stream are now matters of important consideration owing to its vastly increased traffic.

The break up occurs annually in May. Within the last decade the earliest this has occurred was on the 8th and the latest on the 26th, considering this immediate section of the river. According to an enterprising journalist a tradition of the Moosehide Indians is to the effect that "one summer, a long time ago" the ice remained the summer through.

The breaking is not simultaneous along the entire river, but begins at the head and continues in chronological order toward the mouth. At Eagle, for the four seasons past, it has occurred as follows: 1898, May 8; 1899, May 17; 1900, May 10; 1901, May 15. The last date is probably about the average. It has closed recently as follows: 1898, November 4; 1899, November 24; 1900, November 8.

Navigation usually ends with September, or when ice begins to run heavily. Ice comes earliest from northern tributaries, the Porcupine usually leading. High water usually occurs in June, and low water just previous to the spring thaw. The range between high and low water each year is 20 to 25 feet. Light travel on the ice begins immediately after the freeze up in the fall and continues up to within ten days of the break up, though at both beginning and ending travelers keep within easy reach of shore.

While no one ever expects to see the interior of Alaska become an agricultural country, its possibilities in that line are not so limited as at first supposed. The ground is practically all frozen to a varying depth and covered with soggy moss, and, where level, swamps abound. Almost all localities are capable of furnishing garden spots at least, and the swamps are bountiful sources of native hay which is known to be good fodder for horses and cattle. While the soil is sour and needs cultivation and aeration to render it more productive, hardy vegetables sufficient for all local needs can be grown; radishes, lettuce, turnips, and potatoes do well and are particularly sweet and succulent.

As to the healthfulness of this portion of the Yukon Valley there seems no doubt. While Dawson has had a goodly percentage of sickness from typhoid fever and pneumonia it is mostly traceable to foolhardiness in undergoing constant exposure and fatigue without due or intelligent care in the matters of food, clothing, and relaxation.

NOTES BY THE EDITOR.

A PROPOSED METEOROLOGICAL COMMISSION.

A letter recently received by the Chief of the Weather Bureau from a distinguished citizen in Council Bluffs, Iowa, contains a proposition that may be best explained by the following quotation:

In view of the repeated calamities visited upon the farmers and business men of the country by reason of drought and their lack of knowing the laws of nature, why would it not be for the best, to appoint a commission of experts to investigate and formulate a system by which a foreknowledge of the seasons can be obtained, and the information diffused regularly hereafter, so that the farmers will know what to plant and sow, and thus save themselves from such calamities as we are now experiencing? * * * It is useless, it is criminal to say such a system can not be formulated. Years of study and investigation have convinced me that it can. I have sought no publicity in such matters because I am only a plain citizen who has been humbly doing all the good he could for his fellows. The ancient students of meteorology had this knowledge, and as the same laws are still existing, and as progressive men have knowledge of their workings, there is no reason why they should not be utilized for the benefit of mankind. Calling such men "cranks," "charlatans" and other epithets does no good, and does not alter one law of nature. Philanthropists never talk that way, but investigate and put truths in active force for the public blessing. * * * I have mentioned these men because they are experts, although in some cases of opposing schools. Yet they are possessed of sufficient charity and intelligence to agree upon mutual concessions and formulate a system that will do away with the misery experienced by the unfortunate in these recurring famines, whose effect, under such a system can, as I believe, be materially ameliorated if backed by the authority and dignity of this Government.

The reply of the Chief of the Bureau to the above letter emphasizes some points that are, perhaps, apt to be forgotten by the public at large, and we venture to make the following extract, which clearly defines his own convictions and expresses the general concensus of opinion among all throughout the world who have a right to be called meteorologists.

While recognizing the incalculable value of a foreknowledge of seasonable weather conditions, I am not prepared to concur in your belief regarding the possibilities of acquiring this knowledge, or accept your estimate of the knowledge possessed by the ancient students of meteorology. The Egyptians and Greeks conducted a system of observations, and determined by the transit of the stars, and the rising of the constellations the march of the various seasons suitable for agriculture or for the irrigation of lands. The Egyptians also had gages to accurately note the height of the Nile, and by the flow of that river, and by its height or lowness at certain seasons, they calculated whether flood or drought would follow. For, upon the height of the Nile depended the success or failure of the coming harvest time. The meteorological knowledge of the ancients was, so far as history shows, limited to a knowledge of the effects of visible conditions. Thus, when the Nile watered the agricultural districts of Egypt, good harvests followed; when the Nile was low the fields were dry and a season of dearth followed. * * * Modern meteorological knowledge has been acquired during the last century, and it is certain that prior to the year 1820, when Redfield announced his discovery of the laws of storms, the scientific world possessed no definite knowledge of the laws which govern the movements of the atmosphere, and which control its various phenomena. * * * It is believed that the Weather Bureau of the Department of Agriculture is thoroughly familiar with all meteorologic knowledge, both ancient and modern, and that every legitimate effort is being made by that Bureau to acquire a foreknowledge of the weather which will be useful to farmers in seasons of planting and harvesting.

The subject of seasonable weather forecasting is receiving special attention, and all lines of investigation which are calculated to establish laws which control future weather conditions are being exhaustively followed. That these investigations may be successful, is the earnest wish of every modern student of meteorology.

The above correspondence suggests a few additional thoughts which may be worth publishing if thereby we may allay any uneasiness in the minds of those whose property in crops and cattle is frequently destroyed or threatened with destruction by droughts and floods, winds and lightning. Previous to November 1, 1870, the citizens of the United States, rarely recognized the possibilities of foreseeing the weather twenty-four hours in advance with any greater certainty than that attained by the local wisdom of the oldest residents. On that date they awoke from this dream of ignorance and began to dimly comprehend the fact that by persistent study, if the proper data are at hand, man will be able to predict the weather to a certain limited degree of refinement. Since that day the Weather Bureau has made some progress and is probably now doing all that can be done with the available data. In order to do better, we need on the one hand daily weather maps, covering a broader extent of continents and oceans, and similar maps for the upper regions of the atmosphere, such as can only be furnished by the use of kites, balloons, and mountain stations. On the other hand, we need a much more profound investigation of the mechanical problems involved in the motions of the atmosphere than has as yet been possible for man to execute. There is a limit to what any man or any generation of men can accomplish. We are always building upon the foundations that have been laid by our predecessors. Occasionally a genius strikes out on some wholly new plan of operations and then the world of science takes a new start. The progress of knowledge since the days of Aristotle may be divided into periods marked by the advent of such men as Copernicus, Galileo, Newton, Fourier, Gauss, Helmholtz, Riemann, and Maxwell. The progress of meteorology is due to the devotion of such men as Redfield, Espy, and Ferrel, among the dead, and Hann, Mohn, von Bezold, Mascart, Eliot, Wild, and Neumayer, among the living. A host of names of other active workers might be mentioned, but these men and their assistants have solved some of the difficult problems that beset the path of progress, and it is by a continuance of such work as they have done that we must expect final success. We are one with the farmers and business men of the country in their desire to hasten the progress of our knowledge by the discovery of unknown laws of nature, but they must not expect these laws to be written out in such plain terms that a "commission of experts" can "formulate a system by which a foreknowledge of the seasons can be obtained, so that the farmers will know what to plant and sow." It is not likely that the simplest rational system of weather prediction could be easily handled by the farmer. The latter now gets his knowledge of the astrological predictions from the farmer's almanacs which are for sale everywhere in this country and Europe. If the farmers wish anything better than these they must for the present be content with those that are published by the official weather bureaus of every civilized country.

There is no nation that does not now maintain a system of telegraphic reports of the weather and daily predictions carefully compiled therefrom. These forecasts for the coming day, or two days, represent the best thought of conservative students who would not publish a prediction that has not nine chances out of ten in favor of its verification.

As a matter of fact, every national government weather bureau in the world has in its employ one or more experts whose thoughts are given principally to the improvement of its methods and especially the invention of some satisfactory method of long range forecasts or general predictions of the character of the seasons one month or six months or even a year in advance. It is well known that in this matter of seasonal forecasts the meteorological reporters for the government of India, Mr. Blanford and Mr. John Eliot, and their assistant, Mr. William Dallas, have thus far taken the lead. They have, in fact, experienced but one serious failure in the

last fifteen years in the forecast of monsoon rains. Their methods are very special, adapted only to India, and not applicable to the United States. Doubtless equally good methods will be invented to meet the necessities of American farmers, but these will almost certainly not be devised by a mixed commission of astronomers and inventors and astrologists, such as those specifically suggested by the author of the above letter. It is to some one man that we must look, one who shall patiently study the subject in the light of a complete knowledge of the mechanics of the earth's atmosphere—just as La Place advanced astronomy by his exhaustive knowledge of celestial mechanics. A commission or committee often serves a good purpose in collecting data or suggesting problems for others to work upon, or in stimulating the best efforts of ambitious students, but we do not know of a single case in which such a commission has itself successfully investigated an abstruse problem, such as that offered by the atmosphere. An investigation in an almost untrodden field can best, and we may say only, be carried out by one individual. He may have many assistants to do the computing, the searching, and the humdrum mathematical work, but his own clear thought must dominate the whole.

In so far as the problems of meteorology can be resolved by study, progress will be best accomplished by the help of a so-called meteorological laboratory or a school of meteorology, established in connection with some one of our universities, in which special attention is paid to the mechanics of the atmosphere with its attending physics and mathematics. Analogous laboratories and observatories in Europe have given us all the knowledge that modern science possesses of astronomy, chemistry, physics, physiology, and electricity. Galileo's wisdom was communicated to the world through his experimental work and lectures at the universities of Florence, Padua, and Pisa. The universities of France, Germany, and England have developed those who add to knowledge as distinguished from those who teach and those who apply. The investigator, the teacher, and the inventor has each his own work to do. We have at present in this country not a single university where meteorology is studied and taught as a branch of applied physics and mathematics. Our most eminent Ferrel, the founder of modern meteorology, was always a Government employee and was deprived of the great stimulus that comes from daily association with post graduate students. Even European universities have but lately given the modern dynamic meteorology its proper rank alongside of astronomy, mathematics, and electricity, and above the old fashioned statistical climatology. Nothing stimulates a man of thought more than the consciousness that ambitious students are following him in his investigations and will take up the thread of study where he lays it down. Ninety-nine per cent of the beautiful and important investigations annually published by the young candidates for scientific honors in American and foreign universities are but the development of ideas awakened in the student and disciple by the deeper thought of the master. Happy the youth who studies under such masters. Happy the university that is wise enough to keep such men in its faculty.

The author of the above letter from Council Bluffs says that "years of study and investigation have convinced him that a system can be formulated by which a foreknowledge of the seasons can be obtained." We quite agree with him as to this conclusion, because, on general principles, we believe that the gradual increase in knowledge and the development of the intellect of man will give him a complete insight into nature's laws. Not that we can change the laws, but that we can understand them and use them. Our conclusion is not based upon special study and investigation so much as it is upon a general philosophic survey of the progressive intellectual development of Europe, and our readers will be glad to know in detail the arguments and investigations that have brought our correspondent to his conclusion.

It has always seemed to the Editor very strange that so many are inclined to attribute to the ancients a perfection in civilization and knowledge greater or even as great as that which we enjoy at the present day. During the past century, one may often meet in literature with the expression "the lost arts," as though something that could be of value to us had been known long ago but is now irrecoverably lost. We very much doubt the truth of this proposition. In the present case we certainly have no evidence whatever that the ancient students of meteorology had a knowledge that would enable them to make seasonable forecasts of the weather at all comparable with those that are called for at the present time. We do know, in a general way, that the Chaldeans supported a priestly class who studied the stars, probably also the atmosphere, and predicted future events in the lives of men by means of astrological rules. Some fragments of their knowledge are being translated for us from the cuneiform inscriptions of Babylon, Nineveh, Erech, and other cities whose ruins have fortunately been preserved. The documents that have thus far been translated reveal a state of civilization and a social organization adapted to the needs of those nations but in no way superior to what we ourselves enjoy at the present day. This Chaldean system of observation and investigation doubtless continued for several hundred years, yet it had not in it that spirit of progress which marks the present civilization of Europe and America. We hope, indeed, that documents will be discovered showing that the priests had arrived at some important meteorological generalizations; yet this is only a hope; nothing of the kind has as yet been found out, nor any indication that it ever existed. The Chaldean meteorology, even if it were preserved to us complete, would probably be as barren of valuable results as are the voluminous records that have been preserved in China and India for the past two or three thousand years. The art of investigating nature, and of determining the exact phraseology of her laws, and the art of applying this knowledge to the daily needs of mankind, is almost wholly the creation of modern times, beginning with Galileo and Newton. We shall not draw any inspiration from the ancients. The future growth of meteorology must be founded upon the study of mathematics, mechanics, and physics, as taught in the scientific schools of modern universities. Our author pleads for fair treatment of those who are called "cranks," "charlatans," "astrologers," etc., whom de Morgan calls "paradoxers"; but these are the very ones who have nothing to do with modern science. They are to science what the anarchists are to society. They can not reconcile themselves to the world as it is, and are content to live in a dreamland where matters are arranged very differently from what they are on this earth. Common sense demands that we who live on the earth should abide by the laws that regulate this material world.

In the last portion of his letter, our correspondent says that the experts mentioned by him, and representing opposing schools of astronomy and astrology, "are possessed of sufficient charity and intelligence to agree upon mutual concessions and to formulate a system that will do away with the misery experienced by the unfortunate in these recurring famines." But does the country really want a system of weather predictions based on "mutual concessions" by the wrangling representatives of opposing schools? What have their "mutual concessions" to do with the laws of nature? Do we not rather want a system based upon the natural facts and laws, unbiased by human theories? Would it not be just as well for the opposing schools, each by itself, to formu-

late its own system, if it has any, and give us a chance to see whether either is at all satisfactory as a basis of long-range forecasting? The Weather Bureau is not so wedded to the daily weather map, with its clear presentation of the actual state of affairs and the general drift of the weather for the next few days, but what it would quickly adopt the horoscopes of the astrologer or the cycles of the empiricists if there were the least chance of doing anything with these methods more satisfactory than is being done at the present time. It can not be too strongly stated that up to the present time no man has yet appeared who has shown himself able to deduce all the consequences in weather and climate that flow from the action of the sun's heat upon the earth, the ocean, and the clouds, and until that has been accomplished the study of the infinitesimal influences of the sun spots, the moon, the planets, and the stars, is wholly uncalled for and irrational.

UNIVERSITY RESEARCH AT WASHINGTON, D. C.

The proceedings of the last Convention of Agricultural Colleges and Experiment Stations held in November, 1900, have lately been published as Bulletin No. 99 of the Office of Experiment Stations. There are a number of addresses and discussions that will undoubtedly interest those Government officials who are hoping for the broadest development of university education in order that the various departments may secure the highest type of men to carry on the scientific work of the Government. The committee on graduate study at Washington pointed out the great stimulus that has been given to this subject by the appointment of "scientific aids in the Department of Agriculture," whose term of service is at present limited to two years, and whose maximum compensation is $40 per month or sufficient to cover a portion of the living expenses, while the young men who must be graduates of land grant colleges have an opportunity to show what they can do in the way of original research in lines of work that are important to the Department.

The discussion as to the propriety of establishing a national university or a Washington memorial at the capital has also taken a prominent place at the July convention of the National Educational Association in Detroit, and it has also been brought prominently forward by the Chicago address of the Director of the United States Geological Survey, Dr. C. H. Walcott. Apparently all the practical agitators of this subject are in accord with the ideas published in the MONTHLY WEATHER REVIEW,[1] to the effect that the Government has already long since established its land grant colleges representing in general the under graduate or collegiate department of the proposed national university. It has now only to coordinate the systems of instruction in these colleges by the appointment of a board which may very properly be called the regents of the university. It can then authorize these regents to establish the conditions under which graduates from these, and probably other institutions, may continue their studies in Washington and attain the higher or university degree. In this latter portion of the work the investigators and the laboratories, the museums and the libraries, the literary and legal authorities in the employ of the Government can be utilized, but, of course, many additional facilities must be provided.

The fact that there is often a demand for a man who can do original work rather than for one who knows all about what others have done, suggests that there should be an intimate relation and friendly cooperation between such a national university and the Civil Service Commission.

The address by President Stubbs of Nevada, and especially that of J. K. Patterson, contained in the above-mentioned Bulletin No. 99, emphasize the necessity of a systematic coordination of the courses of study.

[1] MONTHLY WEATHER REVIEW: February, 1898, pp. 63-64; Civil service examinations. December, 1898, p. 548; Civil service examinations for observers in the Weather Bureau. December, 1898, p. 564; Civil service examinations for assistants in the Department of Agriculture. May, 1899, p. 213; Scientific aids in the Department of Agriculture.

INSTRUCTIONS TO THE VOLUNTARY METEOROLOGICAL OBSERVERS OF THE UNITED STATES HYDROGRAPHIC OFFICE.

Under the above title a pamphlet by Mr. James Page, Meteorologist to the Hydrographic Office, has just been published from which we make the following extracts which show the work being done at the Hydrographic Office in charting the weather from day to day in response to the demands of modern meteorology, as well as the tabulation of the data for use in preparing monthly and annual means.

We notice that on page 26 mariners are instructed not to apply the reduction to standard gravity when they use mercurial barometers, but that they may apply an inverse correction to the aneroid. This seems to be exactly contrary to the recommendations of all the international meteorological conferences. Our own experience is that at sea the aneroid is quite as reliable as the mercurial, and of course it needs no correction for gravity.

In the days of Maury, and for some years subsequent to the period of his greatest activity, the common aim of the various institutions engaged in the study of ocean meteorology was to obtain for each unit area of the sea's surface (generally a field bounded by the even 5° parallels and meridians, 5°, 10°, 15°, etc.) a reasonable number of observations of wind, weather, etc., extending over any period of years. The observations were then assembled by months, the average for each month taken, and the result stated as the normal condition for the month, i. e., the condition which the mariner might expect to find most frequently prevailing throughout the given field or square during the given month. Sailing routes were then laid down for the successive months in accordance with these normal conditions, and shipmasters were instructed to adhere to these routes as rigidly as the winds would permit, even when convinced by their own experience of weather changes, as well as by the indications of their meteorological instruments, that better results might be attained by adapting the course of the voyage to the conditions actually encountered.

With the advent of weather forecasting as a science, using as a basis the daily synoptic weather charts, a new importance was attached to the sailor's meteorological observations. It was seen that in taking them he was not only adding to the stock of general knowledge of the climatology of the sea, the value of which to him was future and problematical, but also that he was putting himself in possession of certain special knowledge the value of which might prove absolute and immediate. His last preceding observation revealed a certain existent condition of the meteorological elements, his present observation a more or less different condition. What did the changes which had taken place during the time intervening between the observations foretell? Did the existence of adverse winds in his immediate neighborhood imply better or worse conditions elsewhere? If better, would he not, in this instance be justified in abandoning the route which had been laid down for him as the best under average circumstances, and seeking that which his present observations led him to believe would prove more favorable?

A satisfactory answer to these various questions demands, in addition to a knowledge of the general periodic changes which occur in the several meteorologic elements from season to season, and from month to month, a knowledge of what may be termed the nonperiodic or accidental changes which occur from day to day; of the relation which exists between the simultaneous changes in the several elements and of the effect which a decided variation of pressure, temperature, or wind in any one neighborhood has upon the conditions existing in other parts of the ocean.

To obtain this latter knowledge it is requisite that we have at hand for the purpose of study a series of charts or pictures, as it were, of the weather covering the entire ocean at a given instant of time, taken at regular intervals so brief that we may be confident that no marked change can occur without appearing in its different stages upon several of the pictures in succession. An examination of this series will then serve to reveal what changes have taken place in the interval separating any two of them; to trace the development and progress of any

disturbance of the normal conditions that may have arisen; to compare the conditions of wind and weather prevailing simultaneously at points of the sea more or less remote from each other; to determine the constant relation, if any, which exists between these conditions; to make plain the manner in which a vessel, beset by foul winds, might have been navigated, with the result that these winds would have been avoided, or even been replaced by fair; and finally to instruct the navigator as to the conclusions to be drawn from his meteorological observations, in order that this result may be accomplished.

It was with a view of combining these two equally essential methods of meteorological investigations—the old, having for its aim the collection of a large number of reliable observations to serve as a basis for the study of the climatological changes as they occur from month to month,—and the new, having for its aim the collection of a large number of daily simultaneous observations to serve as a basis for the study of the weather changes as they actually occur from day to day—that the present form of weather report was adopted. It demands but a single observation per day, instead of the twelve demanded by the Meteorological Journal, this large reduction being made in the hope that the number of observers would increase in the same ratio as the services required of them would diminish, a hope which has proved more than justified. This single observation, however, is to be taken each day over the entire globe at the same instant of time, viz, Greenwich mean noon. The local or ship's time of the observation will thus vary with the longitude.

The daily synoptic weather charts.—The next step is the utilization of the observations in the construction of the daily synoptic weather charts.

A suitable series of outline charts of the various oceans having been prepared and dated, one for every day in the year, the observations contained in the report are plotted, one by one, each in its proper position upon the chart of corresponding date. For this purpose a system symbols is employed which shows at a glance the height of the barometer, the direction and force of the wind, the proportion of clouded sky, the nature of the precipitation, whether rain, snow, or hail, the presence of fog, the character of the weather, etc., all precisely as recorded by the observer, with the exception of the reading of the barometer, which is first corrected for initial error, and (if mercurial) for temperature. For the North Atlantic Ocean, the first reports to reach the office, and consequently the first observations to appear upon the chart, are those returned by the westward bound transatlantic liners. These are closely followed by the slower steamships from Europe and the West Indies, and these in turn by the homeward bound sailing vessels. The last reports to appear are those of eastern Asia. These are sometimes as much as a year late in reaching the Hydrographic Office, owing to the practise of holding them until the return of the vessel to the United States. Masters are therefore earnestly requested to avoid this delay by forwarding their observations on reaching their first port. The contingent furnished by the sailing vessels is of the highest value, as the observations taken aboard the latter are free from certain constant sources of error introduced by the speed of steamships.

As the reports from these various sources accumulate, the plotted observations become more and more densely distributed over the chart, each plotting representing the position of an observing vessel at the instant of Greenwich noon and the conditions prevailing in its vicinity at that instant, until in its final shape the chart for each day offers to view a complete picture of the pressure, wind, and weather covering the entire ocean at the hour and minute of Greenwich mean noon of the day in question.

A word as to the value of such a series of charts to the navigator. As is well known, the governing features of the weather in the extratropical regions of both hemispheres is the practically ceaseless procession of areas of alternately high and low barometer which move around the earth with varying velocity in a general easterly direction, each accompanied by its own system of winds circulating about the center, the direction of the circulation being cyclonic around the area of low barometer, anticyclonic around the area of high. The synoptic charts of the various oceans enable us to follow up the movement of these areas from day to day, to mark the changes which take place in them, and to study the effect of these changes in modifying the weather. It is from this source that the path followed by each of the several barometric depressions that occur during the month, as given on the Pilot Charts of the North Atlantic Ocean, is derived, the aim in thus displaying the daily movement of the storm centers being not only that mariners may have at hand the means of explaining in accordance with the law of storms the occurrence of any heavy weather encountered, but also that by studying this feature of the Pilot Chart, seeing track after track repeat itself with some slight modifications, they may come to know in what part of the ocean to expect disturbances, what will be their character, extent, and duration, and what the direction and velocity of motion of the vortex.

It is, however, in the light of the assistance with which careful study of these charts will ultimately furnish the mariner in properly interpreting his own isolated observations, that they have their main value. If we look through a series of such charts, the first impression gained is that they are of endless variety, each one being apparently a law unto itself. Close observation, however, will soon reveal certain points of similarity, especially in the position and extent of the areas of high barometer, and consequently in the outflowing winds which surround them, a given distribution of pressure often appearing to hold sway for several days in succession, only to be supplanted by some quite different but equally persistent arrangement. Careful study has thus shown that the daily synoptic weather charts of the North Atlantic Ocean may, with certain restrictions, all be referred to one or another of a limited number of types, each type possessing certain characteristic features, which vary from season to season, and each exhibiting a certain degree of persistency.

It is upon the study of these *types* of weather, their character, duration, and order of succession, that the hope of eventually predicting the weather over the ocean several days in advance rests. Such a study demands that the meteorologist have at hand a series of daily synoptic charts, accurate in every respect, and covering the ocean, especially in the higher latitudes, as widely and as completely as possible, and it is to the merchant marine that he must look for the material necessary for the construction of these charts. Once having attained a knowledge of these types, moreover, the ability of the mariner to forecast the weather from his own isolated observations would be vastly increased. Knowing the type of weather prevailing, his observations of pressure, temperature, winds, and clouds, would gain a new importance, showing whether the type was about to change, and in what direction.

The tabulation of the observations.—Having served their purpose in the construction of the daily synoptic charts, the observations are ready for tabulation. For this purpose the surface of the ocean is supposed to be divided into a number of fields or squares, bounded by the even 5° parallels of latitude and meridians of longitude, 0°, 5, 10°, 15°, etc. The observations are then separated according to months, and all of those within a given square and during a given month (irrespective of the year) are assembled. The next step is to obtain for each month and each square the average temperature of the surface of the sea, the ratio that the winds from each compass point bear to the total number of winds, the average force of the winds, the frequency of the various forms of clouds, varieties of weather and character of the sea, and the average velocity and set of the current. These final values are then carefully tabulated and mapped, and the results given to the seafaring community in the shape of the Monthly Pilot Charts published by the Hydrographic Office.

LUNAR INFLUENCES IN METEOROLOGY.

The admirable elementary treatise on meteorology by Prof. Alfred Angot of the Central Meteorological Bureau in Paris, published in 1899, concludes with a chapter on the prediction of the weather and the regular periodicities that have been sought for in meteorology. After showing that long-range predictions can not yet be made by utilizing any such periods, and that even the sun spots have not yet been shown to have any special influence. Angot adds a paragraphs with reference to the lunar periods, which we translate as follows:

The idea that the moon exerts any influence on meteorological phenomena goes back to the most ancient times; there is no belief that has left more traces in the popular traditions in regard to the weather, nor that has been the subject of more controversy.

Let us recall that the time occupied by a true or sideral revolution of the moon is 27d. 7h. 43m, or 27.322 days; the apparent or synodic period, after which the sun, earth, and moon return to their same respective positions, is a little longer, viz, 29d. 12h. 44m., or 29.531 days, it is after this latter interval that the *phases* of the moon again become the same. The *anomalous revolution* or mean value of the intervals of time separating two consecutive passages of the moon through its shortest distance from the earth, is 27d. 13h. 19m., or 27.555 days. Finally the orbit of the moon has a mean inclination to the ecliptic of 5° 8′ 48″; the maximum declination of the moon. therefore, varies between 18° 10′ and 28° 45′, while the maximum declination of the sun is 28° 27′.

The moon imparts to us only a very small proportion of the light and heat that she receives from the sun; the heat that she sends toward the earth is so feeble that the most powerful instruments and the most delicate methods of measurement must be employed to discover it; there can, therefore, not be any question of a luminous action of the moon and much less of a caloric action, and we can scarcely think of anything else but an attraction analogous to that produced by the tides on the great masses of water of the oceans. It is, therefore, necessary to first seek to discover whether the action of the moon does produce atmospheric tides that show themselves by the periodic variations in the height of the barometer.

If we observe the pressure at the lunar hours, that is to say, when the moon passes the meridian, and she is distant from it 15°, 30°, 45°, etc., and if we take hourly means of the values observed during a very long period of time, in order to eliminate the disturbances, these means

will certainly give an indication of a lunar tide, but extremely feeble; it will only be found at the equatorial stations and disappears entirely in the middle latitudes. At Batavia the maximum pressure occurs a half-hour or an hour after the upper and lower passages of the moon over the meridian; the minimum occurs from six to seven lunar hours after the maximum; the total extent of the variation is only 0.11 millimeter, which corresponds to a column of water of about 1.5 millimeter [or one seven-thousandth part of the standard average atmospheric pressure.—ED.]

The insignificance of the diurnal lunar variation of pressure indicates that this must also be true of the variation corresponding to the revolution of the moon around the earth, that is to say, to the phases of the moon. In Batavia the pressure is the feeblest at the time of new moon and most powerful shortly after the period of full moon; the total extent of this oscillation does not reach 0.2 millimeter. The diurnal rotation and the synodic revolution of the moon therefore cause tides in the atmosphere as well as in the oceans, but the atmospheric tides are so extremely feeble that they scarcely exceed the limit of accuracy of the barometric observations.

The study of the influence of the synodic revolution, or of the phases of the moon, upon other meteorological phenomena produces results which are absolutely contradictory, and which have been discussed in detail by Arago and, more recently, by Van Bebber. We shall, therefore, limit ourselves to summarizing briefly the conclusions arrived at by them.

The temperature, the cloudiness, and storms do not show any periodicity in relation to that of the phases of the moon. In Germany north and northeast winds seem most frequent in the period of the last quarter of the moon and most rare in the first quarter; the southwest winds show an inverse variation. But this law has not been verified in any other countries.

At Paris and in Germany the maximum number of rainy days occurs between the first quarter and the full moon; the minimum number between the last quarter and the new moon. The relation of the maximum to the minimum is 1.26 at Paris and 1.21 in Germany. It would, therefore, at first sight seem that there is here a true law and that the prospects for rain are greater by a fourth or a fifth after the first quarter than after the last. But even this would be too slight a difference to be made use of for a serious forecast. Besides, this law does not hold good for the south of France. At Orange, for example, the minimum of days with rain occurs between the full moon and the last quarter and at Montpellier in the first quarter. If there is any relation between the phases of the moon and the rainfall, this relation is, therefore, very complex and variable from one region to another.

The study of the changes of the weather has produced still less convincing results. In discussing the observations made at Padua in the last century, Toaldo found that, according to the popular belief, the weather is much more variable at the time of new moon than at the other lunar periods. But convinced in advance of the existence of the influence that he wished to demonstrate, Toaldo attributed to the action of the new moon the changes in the weather occurring one or two days either before or after; whereas for the rest of the lunar period each day was considered separately. If now rigorous computations be made, giving to each day the same value, there will no longer be found any trace of the influence of the phases of the moon on the changes of the weather. During the past few years the study of the influence of the moon has been again taken up in a manner apparently more scientific. In the first place, all idea has been abandoned of finding any relations between the meteorological phenomena and the phases of the moon; that is to say, the synodic revolution which represents only the relative positions of the earth, the moon, and the sun. Then the anomalistic revolution was studied, which corresponds better to the respective real positions of the earth and the moon. But, above all, the position of the moon in declination has been compared, not with any special local meteorological phenomenon, such as temperature, rainfall, changes of the weather, etc., but with the distribution of pressure over the surface of the globe as a whole. The fundamental idea of these researches is that the movements of the moon in declination may lead to general displacements of the air, or a balancing between the tropical regions and the higher latitudes, and thus cause periodical changes, such, for example, as in the boundary of the trade winds and in the law of change of pressure with latitude. We should then understand that a movement of a zone of high pressures, for example, might cause fine weather on one side of the zone and at the same time foul weather on the other side, and that these variations, which at first sight seem contradictory, might nevertheless be due to one and the same cause. These studies are, however, of too recent date and still too undeveloped to have already given results that may be considered as sufficiently conclusive and general. It is, however, interesting to mention them here, since by continuing to work in the same lines we may, perhaps, succeed in discovering the true relations between the moon and the phenomena of the weather, since the earlier researches have not brought about any positive conclusion. On the whole, in the present state of our knowledge, it can not be affirmed that the moon does exert any influence upon the weather, but at the same time it should not be denied that this influence may possibly exist. In any case, it would show itself by complex phenomena, such as the displacement of the zones of high and low pressure, and might cause very different results in different regions.

In concluding the examination of the various opinions in regard to the influence of the moon, it may be well to say a word on the opinions concerning the *lune rousse, or harvest moon*. This name has been given to the lunar period which, beginning in April, has its full moon either in the second half of that month or in the month of May; if there are two new moons in April it is with the second that the harvest moon begins. Agriculturists declare that often at that time, when the sky is clear and the moon shines brightly during the night, the tender buds are frozen and turn red even although the temperature of the air does not fall below freezing; nothing of this nature occurs if the moon remains hidden behind the clouds. The explanation of this phenomena is very simple and the moon has no part in it. When the sky is clear and the atmosphere dry and transparent (this is the time when the moon shines most brightly) the temperature of the bodies subjected to the nocturnal radiation falls far below the temperature of the air. If, during the day, the temperature has not been very high the nocturnal radiation may then chill the plants below freezing and they will freeze although the air remain at a higher temperature; on the other hand the plants will not be frozen if there are clouds to diminish the radiation. The conditions that lead to these freezings are therefore a clear sky and a relatively low temperature during the day. At the end of May or June the mean temperature is generally too high to allow us to fear these freezes although they do occur sometimes. Before the commencement of the harvest moon, that is to say, at the end of March or the beginning of April, the temperature is lower than during the harvest moon itself; the conditions are therefore much more favorable for freezing by radiation; but as the vegetation has not yet begun these freezes do not cause any damage and do not attract any attention. We have here to do with a very simple phenomenon in which the moon plays no other part than merely to indicate by its brilliancy when the sky is pure and transparent.

In the countries in the south of France, where the vegetation is more advanced than in the center and the north, the critical period of vegetation is no longer during the harvest moon but during the lunar period which precedes it.

THE RED DUST OF MARCH, 1901.

In connection with the remarkable dust storm that prevailed over a large part of Europe between the 10th and 13th of March, Monsieur M. Barac, director of the petroleum refinery at Fiume has made an examination of the dust and we quote the following from his report.

The chemical analysis of the dust gave the following results:

	Per cent.
Silicic acid ($Si\,O_2$)	49.49
Oxide of iron ($Fe_2\,O_3$)	9.96
Clay ($Al_2\,O_3$)	12.10
Oxide of manganese ($Mn_3\,O_4$)	1.99
Oxide of calcium ($Ca\,O$)	11.46
Oxide of magnesium ($Mg\,O$)	0.40
Carbonic acid ($C\,O_2$)	8.96
Organic substance	5.48
Traces of sodium, sulphuric acid, hydrochloric acid and loss	0.16
Total	100.00

The microscopic examination, under a power of 640, shows that the mass was composed principally of colorless, mixed with a small portion of colored, irregular fragments of crystals and particles of minerals together with the skeletons of micro-organisms and small particles of soot. Small quantities of well-formed, sharp-edged rhombohedric carbonate of lime, quartz prisms, and cubes of chloride of sodium, and the lime as well as the quartz crystals showed the phenomena of chromatic polarisation.

In regard to the diameters of the particles, the smallest were 0.001 millimeter, the average 0.017 millimeter, while the maximum size of the fragments of crystals was 0.051 millimeter, and that of the structureless mineral particles 0.113 millimeter.

If we compare these results with those published by A. E. Nordenskiold, Zeit. Oest. Gesell. für Meteorologie, relative to the dust that fell May 30, 1892, in Sweden, we are led to conclude that the dust of 1901 belongs to the same class as the

so-called trade wind dusts which blow from Africa over the Atlantic Ocean. The total quantity of the dust that fell on March 11 averaged 260 grams to 1,400 square meters in Fiume.

The effect of this dust floating in the atmosphere was to produce a reddish haze and to diminish the amount of insolation at the earth's surface thereby doubtless increasing the temperature of the air in the upper strata. The general color of the dust when dry and collected in quantity is a bright reddish brown; a sample of it presented by Monsieur Barac is deposited in the Library of the Weather Bureau.

THE MILWAUKEE, WIS., CONVENTION OF WEATHER BUREAU OFFICIALS.

At the conclusion of the Milwaukee Convention we are filled with the conviction that the triennial convention has come to stay. This was the second general convention preceded by seven or eight meetings of the more restricted character, and has demonstrated beyond all peradventure that nothing gives such a stimulus to development of new ideas, the removal of doubts and troubles, the incentive to better work; nothing so firmly cements the bonds of friendship or the highest esprit du corps as these few days of personal intercourse between the Chief and his representatives throughout the country. In a few remarks made by our distinguished Voluntary Observer Rev. Father Odenbach, S. J., of Cleveland, Ohio, he expressed with great earnestness the impression made upon himself by his intercourse with those present by saying that he was convinced that so far as he knew there was but one other organization in the world, namely, that to which he himself had the honor of belonging, that could compare with the Weather Bureau in intelligence, discipline, and devotion. To his mind there could be no doubt of continued success, and the final overcoming of every difficulty, scientific and practical, so long as we maintain our present high standard in these three directions.

Nothing could exceed the perfection and convenience of the arrangements made to accommodate the convention and facilitate work, and as for the hospitality and the entertainment that were offered to the members and their wives when their time was not occupied in the work incident to the meeting, it was both elegant and lavish.

On the opening day of the session a clear sky and an easterly wind set forth to perfection the beauty of Milwaukee and the adjacent lake. From the windows of the Convention Hall, as one listened to the speakers, the eye was frequently tempted to glance through the banquet hall of the Hotel Pfister and rest upon the sparkling sapphire of the distant water. We hope that at some time or other every official of the Weather Bureau may have the opportunity to feast upon the beauties of Milwaukee and her lake.

As every thing that was said and done has been fully recorded by the skillful pen of Mr. R. M. Reese, and will be published in Mr. Berry's final report, it will be unnecessary for the Editor at the present time to dwell upon the details of the meeting. Every one expresses delight at the strong stand taken by the Chief in his opening address and subsequent remarks in favor of increased attention to special scientific work, more profound investigations, more perfect meteorological laboratory, more thorough instructions in preliminary physics and mechanics. The papers read by Professors Bigelow and McAdie, and by Messrs. Fulton, Schultz, Glass, and Fassig gave a special pleasure in their support of the urgent need of higher scientific work, whose importance was insisted on by every member of the convention. There appeared to be a wide diversity of opinion as to whether meteorology should be introduced as a special study into the public schools, owing to the present crowded condition of the curriculum, but there was no doubt but that the lower grades of public schools really demanded the study of the clouds, the weather, the thermometer, and other simple matters as being appropriate branches of the so-called study of nature. These are items of knowledge that should be familiar to every citizen, and they are items picked up by the children very easily without adding a moment to the time devoted to the study of books. They are taught as object lessons by what may be called kindergarten methods. The advantages to be derived from giving systematic popular lectures to farmers' institutes and other such gatherings were specially dwelt upon by Messrs. J. Warren Smith, E. W. McGann, and J. S. Hazen. Of course to be a good lecturer one must have a clear voice and distinct utterance or articulation, and those who give the most attention to vocal culture will undoubtedly succeed best as lecturers and represent the Bureau most efficiently for the public. Problems of climate in its connection with diseases, vegetation, and all forms of animal life were presented by a number of papers, and the general impression left upon the audience was that, notwithstanding their complexity these must eventually yield to the persevering studies of well trained specialists. Under the heading of Forecasts, ten minutes was especially assigned to Mr. Harvey M. Watts, of the Philadelphia Press, who gave us a most valuable and stirring address on the many points in reference to which improvements can be made in the work of the Bureau and its relations to the daily press. The address was marked by all of the energy, incisiveness, and earnestness of which Mr. Watts is such a master, and was received with unbounded applause and a hearty vote of thanks from every member.

There was not as much time to give to the general discussion as was universally desired, and, as this want of time is likely to be always a hindrance, the Editor heard several state that it might be better to have it known beforehand that initial ten minute papers, followed by one or two well prepared five minute papers, would be expected to cover the subject. But, undoubtedly, the majority desire a freer voluntary discussion, and many expressed the sentiment that the second and third prepared papers could be omitted, and that the whole subject covered by any initial paper should be immediately thrown open to general discussion to be followed in each case by a vote expressive of the general opinion of the convention on the merits of the question.

The seventh section, or the session of August 29, was occupied by remarks from numerous representatives of extensive mercantile interests. Of these the Editor was most deeply impressed by the address of Mr. A. W. Machen of the United States Postoffice Department in charge of the rural free delivery service. Mr. Machen's graphic picture of the inception and rapid growth of that service was quite fascinating. It lies, of course, with the Secretary of Agriculture and the Chief of the Weather Bureau to utilize this new service to the fullest extent in the spread of the morning weather forecast among the rural population. However, it appears that we have not been able to keep up with its rapid growth, and that a large increase in our annual appropriation will be necessary if we make full use of these new opportunities.

The convention regretted very much the absence of Mr. John W. Smith, of Boston, J. R. Sage, of Des Moines, and Prof. R. F. Stupart, of Toronto, but was gratified to listen to Mr. H. H. Clayton, representing the Blue Hill Observatory. It was also especially favored by the presence of the Secretary of Agriculture, whose every word inspired us anew with that devotion to agricultural interests that actuates his every thought and act.

A lively interest was shown in the revelations brought out

by Dr. O. L. Fassig in his paper on the daily barometric wave.

A very successful photograph of the members of the convention was taken on Thursday, noon, copies of which, on the scale of 17 by 11, can be had for $1.25 by applying to Mr. W. M. Wilson, Section Director, Milwaukee, Wis. We take pleasure in adding to our illustrations of the current number of the REVIEW a reduced print of this interesting picture, Plate I.

WEATHER BUREAU MEN AS INSTRUCTORS.

Mr. John R. Weeks, Observer, Weather Bureau, addressed the State Convention of Cotton Growers that met at Macon, Ga., on July 12. Upon his invitation, many of the delegates visited the local Weather Bureau office for the purpose of familiarizing themselves with the general work of the National Weather Bureau.

CORRIGENDA.

MONTHLY WEATHER REVIEW for June, 1901, make the following corrections:

On page 253, column 2, line 6 from bottom, for "following" read "preceding."

On page 253, column 2, line 7 from bottom, for "division is" read "divisions are."

On page 257, column 1, note at bottom of table, omit "the sea."

On page 263, column 2, line 29, for "marked" read "masked."

On page 265, column 2, line 16 from bottom, for "lunistice" read "lunisticii."

On page 268, column 1, line 29 from bottom, for "one-fifth per cent" read "1.5 per cent."

On page 268, column 2, line 5 from bottom, for "five thousand million" read "twenty-five thousand million."

THE WEATHER OF THE MONTH.

By P. C. DAY, Acting Chief Division Meteorological Records.

CHARACTERISTICS OF THE WEATHER FOR JULY.

The one overshadowing feature of the weather for the month was the long and practically unbroken period of intense heat and drought that prevailed during the month over the great central valleys of the country.

The blighting effect of the merciless rays of the sun day after day, supplemented by an almost entire absence of rainfall, threatened the great agricultural regions with ruin so widespread and disastrous as to be scarcely estimated.

Rains and cooler weather the last few days of the month, however, materially changed the outlook and modified to some extent the effects of the most widespread and disastrous hot wave and drought in the history of the country.

PRESSURE.

The distribution of monthly mean pressure is graphically shown on Chart IV and the numerical values are given in Tables I and VI.

Pressure conditions did not differ materially from the normal, except that the permanent area of low pressure over the plateau and plains region was somewhat intensified and extended eastward considerably beyond its normal boundaries. The areas of high and low pressure that moved across the country were generally ill-defined and lacking in energy, in fact, a notable feature of the month was the inconsequential barometric changes from day to day and the resulting stagnation of the lower strata of the atmosphere. Compared with the normal, pressure for July was slightly in excess over a narrow strip along the immediate Atlantic coast from Florida to the Maritime Provinces of Canada and along the extreme northern edge of the Great Lakes. Over the remainder of the country pressure was below the average, attaining a maximum departure below of from 0.10 to 0.15 inch over the Great Basin and Plains region.

Over the region extending from the Rocky Mountains westward to the Pacific and from the lower lakes eastward and southeastward to the Atlantic coast, the pressure for July was generally lower than for the previous month. Over the valleys of the Mississippi and Missouri, the southern Plateau region and the upper lakes pressure was slightly in excess of that for June.

TEMPERATURE OF THE AIR.

The distribution of monthly mean surface temperature, as deduced from the records of about 1,000 stations, is shown on Chart VI.

The hot wave of July, 1901, over the central valleys, embracing the great corn belt of the United States, had its inception in the latter part of June and continued with scarcely a break till about the 27th of July, making a record of continuous heat that will probably be the standard for future years. During this period the sky was practically free from clouds, and day after day the unobstructed rays of the sun were poured upon the parched and sun-dried earth.

Even the nights afforded little relief, for while the absence of clouds ordinarily favors radiation of heat from the earth at night, normal conditions appeared to be totally suspended and the air retained its heat during the nights in a manner that appeared remarkable.

Throughout portions of Missouri and eastern Kansas and Nebraska the daily maximum temperature averaged 100° or more from the 25th of June to the end of July. At Beaver City, Nebr., from June 23 to July 31, inclusive, the maximum temperature averaged 104°, and only on three days during the entire period of thirty-nine days, did the maximum temperature fall below 100°. At Columbia, Mo., from June 22 to July 25, inclusive, a period of 34 days, the maximum temperature averaged over 100°, records probably unsurpassed in the history of the country, except in the desert portions of southern California and Arizona. Throughout all the great corn-growing States of the central-west all previous records, both of the monthly means and maximum temperature were exceeded, and yet a surprising feature of the crop conditions at the end of the month was that so large a proportion of the unmatured crops had stood the fiery ordeal so long without more material injury.

Compared with the normal, the temperature for July was everywhere in excess, except a narrow strip along the Pacific coast and over limited areas of eastern Georgia and the Florida Peninsula. Over all the region from the Appalachian to

the Rocky Mountains, temperatures were far above the normal, attaining a maximum positive departure of nearly 10° daily over the States of the lower Missouri Valley. Over a large section of this area the maximum temperatures exceeded any previously recorded in the history of the Weather Bureau.

Maximum temperatures of 110° and over were recorded at practically all points in Missouri, and over large sections of eastern Kansas and Nebraska, southern Iowa and Illinois, and northern Arkansas and Oklahoma. Maximum temperatures of 110° and over were also recorded in western North and South Dakota and eastern Montana, and over the desert regions of California and Arizona. In order to more clearly illustrate the areas of abnormal maximum temperatures the chart showing the same has been published separately this month, instead of in connection with the values of mean and minimum temperatures as usual. (See Chart IX.)

The average temperature for the several geographic districts and the departures from the normal values are shown in the following table:

Average temperatures and departures from the normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
		°	°	°	°
New England	10	69.7	+ 1.9	− 2.3	− 0.3
Middle Atlantic	12	78.2	+ 3.5	− 1.6	− 0.2
South Atlantic	10	80.9	+ 1.1	−10.6	− 1.5
Florida Peninsula	7	81.8	+ 0.2	−12.5	− 1.8
East Gulf	7	82.1	+ 1.1	− 8.4	− 1.2
West Gulf	7	83.7	+ 1.9	+ 4.1	+ 0.6
Ohio Valley and Tennessee	12	81.6	+ 4.6	− 4.2	− 0.6
Lower Lake	8	75.7	+ 4.4	− 0.9	− 0.1
Upper Lake	9	71.0	+ 3.7	+ 8.1	+ 1.2
North Dakota	8	72.3	+ 3.6	+24.7	+ 3.5
Upper Mississippi Valley	11	82.5	+ 7.3	+13.1	+ 1.9
Missouri Valley	10	83.5	+ 8.3	+23.8	+ 3.4
Northern Slope	7	74.3	+ 4.9	+16.9	+ 2.4
Middle Slope	6	82.0	+ 5.8	+10.3	+ 1.5
Southern Slope	6	81.8	+ 2.5	+ 4.0	+ 0.6
Southern Plateau	15	79.7	+ 1.4	+ 3.2	+ 0.5
Middle Plateau	9	76.3	+ 2.2	+10.2	+ 1.5
Northern Plateau	10	69.3	+ 1.7	+ 7.8	+ 1.1
North Pacific	9	59.1	− 3.0	− 8.7	− 1.2
Middle Pacific	5	63.3	− 1.2	− 2.2	− 0.3
South Pacific	4	70.6	0.0	+ 3.3	+ 0.5

In Canada.—Prof. R. F. Stupart says:

The temperature was below the average from 1° to 3° in the western and northwestern portions of the Territories, also over British Columbia, and above the average elsewhere throughout Canada, except in the extreme northwestern portion of Quebec, where the average was just maintained. In Toronto the mean for July of this year (73°), which is 6° above the average, has only been equaled once during the past sixty years, namely, in 1887, and only exceeded once, namely, in 1868, when a mean of 75° was recorded; consequently, it is fair to assume that as over the greater portion of Ontario the mean was from 5° to 6° above average July, 1901, in Ontario was one of the warmest Julys on record. The mean in Manitoba was also as much as 3° to 4° above the average, as was also the case in several portions of the Maritime Provinces.

PRECIPITATION.

Along the entire northern border of the country and generally east of the Appalachian Mountains the rainfall was in excess of the normal and its distribution such as to promote the growth of all staple crops. Precipitation was also in excess over portions of the west Gulf coast and eastern Florida. From the Appalachian Mountains westward to the Pacific coast the monthly precipitation was below the normal, and over the entire corn belt and the northern portion of the cotton growing States the average was less than 50 per cent of normal. Over large portions of the above area practically no well distributed rains occurred until the last few days of the month, and growing crops were threatened with complete destruction.

Average precipitation and departure from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
		Inches.		Inches.	Inches.
New England	10	3.02	88	−0.4	+ 1.0
Middle Atlantic	12	3.96	93	−0.3	− 2.6
South Atlantic	10	5.78	95	−0.3	+ 1.1
Florida Peninsula	7	5.98	92	−0.5	+ 3.4
East Gulf	7	6.40	105	+0.3	− 0.6
West Gulf	7	3.16	103	+0.1	−10.1
Ohio Valley and Tennessee	12	1.66	41	−2.4	− 8.4
Lower Lake	8	3.09	100	0.0	− 2.0
Upper Lake	9	4.37	142	+1.3	− 3.0
North Dakota	8	3.80	136	+1.0	+ 0.6
Upper Mississippi Valley	11	2.41	65	−1.3	− 6.2
Missouri Valley	10	2.19	56	−1.7	− 5.9
Northern Slope	7	1.74	106	+0.1	+ 1.1
Middle Slope	6	1.34	47	−1.5	− 4.3
Southern Slope	6	1.33	44	−1.7	− 2.1
Southern Plateau	15	1.20	86	−0.2	+ 0.9
Middle Plateau	9	0.18	38	−0.3	− 0.2
Northern Plateau	10	0.32	62	−0.2	− 1.6
North Pacific	9	0.60	67	−0.3	+ 0.6
Middle Pacific	5	0.08	100	0.0	− 0.8
South Pacific	4	T.	100	0.0	+ 1.9

HAIL.

The following are the dates on which hail fell in the respective States:

Alabama, 2, 14, 15, 16, 17, 18, 31. Arizona, 22, 24. Arkansas, 5, 22. Colorado, 18, 24. Connecticut, 2, 3, 11, 19. Delaware, 8, 17. Georgia, 12, 13, 14, 25, 26. Idaho, 3, 9. Illinois, 17, 24, 28, 30. Indiana, 17. Indian Territory, 5. Iowa, 17, 24, 27, 30. Kansas, 2, 5, 15, 18, 23, 24, 27, 29. Kentucky, 17. Louisiana, 13, 14. Maine, 18. Maryland, 2, 7, 17. Michigan, 9, 17, 19, 21. Minnesota, 1, 4, 14, 17, 23, 25. Mississippi, 6, 16, 17. Missouri, 5, 15, 17, 23. Montana, 7, 8, 10, 11, 13, 15, 16, 18, 26, 27. Nebraska, 1, 2, 4, 17, 18, 28, 30. New Hampshire, 2, 17, 18. New Jersey, 2, 3, 6, 7, 14. New Mexico, 14, 15, 16, 17, 18, 28. New York, 2, 7, 18. North Carolina, 4, 7, 20, 22, 28. Oklahoma, 15. Oregon, 2, 7, 11. Pennsylvania, 3, 7, 22, 29. Rhode Island, 19. South Dakota, 4, 9, 10, 14, 15, 25, 26, 27, 28. Tennessee, 16, 17. Texas, 11, 12, 13. Utah, 8, 9, 23, 27, 29. Washington, 3, 13, 15, 27. West Virginia, 1. Wisconsin, 1, 9, 17, 20, 21, 24, 25. Wyoming, 10, 11, 13, 15.

In Canada.—Professor Stupart says:

The rainfall was much below the average over the greater portion of Quebec and throughout the Maritime Provinces. In Manitoba it was for the most part just about the average, but in all the other portions, except in a few isolated localities, it was above the average, and in many localities to a large amount. In Alberta, Edmonton reports the phenomenal rainfall of 11.1 inches, being no less than 8.1 inches above the average. Regina also records an abnormal rainfall of 7.6 inches, and Gatesgarth of 6.13 inches. In Ontario the rainfall was excessive in many districts, more especially in the Georgian Bay and Muskoka regions, where generally the waters of the small inland lakes are reported to be higher now than they were at the spring freshets. Parry Sound recorded 7.9 inches, which is 5.3 inches above the average. The excessive rainfalls in these districts are more remarkable when it is considered that farther to the northward, in the Temiscamingue and northern Ottawa River localities the country suffered from drought and disastrous bush fires. In the Maritime Provinces, Chatham, N. B., was 2.7 inches below average, Halifax, 2.4 inches below, and Charlottetown, 2.3 inches below.

SUNSHINE AND CLOUDINESS.

The distribution of sunshine is graphically shown on Chart VII, and the numerical values of average daylight cloudiness, both for individual stations and by geographical districts, appear in Table I.

Except on the Atlantic and west Gulf coasts and over the lower lakes, the average amount of sunshine was in excess of the normal and cloudiness correspondingly below normal.

The averages for the various districts, with departures from the normal, are shown in the table below:

Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	6.0	+1.1	Missouri Valley	2.8	−1.6
Middle Atlantic	5.5	+0.7	Northern Slope	2.6	−1.2
South Atlantic	5.0	0.0	Middle Slope	3.4	−0.6
Florida Peninsula	5.6	+0.6	Southern Slope	4.0	+0.2
East Gulf	5.0	0.0	Southern Plateau	2.9	−0.4
West Gulf	4.4	+0.2	Middle Plateau	2.1	+0.1
Ohio Valley and Tennessee.	3.5	−1.1	Northern Plateau	2.0	−1.1
Lower Lake	4.2	−0.3	North Pacific Coast	4.9	+0.5
Upper Lake	5.0	+0.3	Middle Pacific Coast	2.5	−0.4
North Dakota	3.7	−0.6	South Pacific Coast	2.1	−0.6
Upper Mississippi	3.2	−1.1			

HUMIDITY.

Over the area covered by the hot wave and drought, the relative humidity was much below the normal, a condition which contributed much to alleviate the suffering to human and animal life compelled to endure day after day the intense heat that prevailed during the month.

The averages by districts appear in the subjoined table:

Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
	%			%	
New England	81	+2	Missouri Valley	54	−13
Middle Atlantic	77	+5	Northern Slope	54	+2
South Atlantic	80	0	Middle Slope	50	−11
Florida Peninsula	80	0	Southern Slope	55	−3
East Gulf	75	−4	Southern Plateau	39	−3
West Gulf	70	−3	Middle Plateau	31	−1
Ohio Valley and Tennessee.	65	−4	Northern Plateau	41	−2
Lower Lake	70	+2	North Pacific Coast	71	−6
Upper Lake	73	+2	Middle Pacific Coast	59	−8
North Dakota	74	+8	South Pacific Coast	63	0
Upper Mississippi	57	−11			

WIND.

The maximum wind velocity at each Weather Bureau station for a period of five minutes is given in Table I, which also gives the altitude of Weather Bureau anemometers above ground.

Following are the velocities of 50 miles and over per hour registered during the month:

Maximum wind velocities.

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Block Island, R. I	2	52	nw.	Marquette, Mich	20	68	sw.
Cape Henry, Va	31	70	nw.	Minneapolis, Minn	28	50	nw.
Chicago, Ill	18	56	se.	Mount Tamalpais, Cal.	15	50	nw.
Cleveland, Ohio	11	51	nw.	Do	16	62	nw.
Dodge, Kan	27	56	se.	Do	21	52	nw.
El Paso, Tex	1	60	ne.	Do	23	51	nw.
Do	18	57	ne.	New York, N. Y	28	54	nw.
Hatteras, N. C	10	52	n.	Do	31	66	sw.
Do	11	62	w.	San Juan, P. R	7	52	ne.
Lexington, Ky	25	50	n.				

ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table IV, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

Thunderstorms.—Reports of 7,732 thunderstorms were received during the current month as against 6,376 in 1900 and 6,670 during the preceding month.

The dates on which the number of reports of thunderstorms for the whole country were most numerous were: 17th, 476; 4th, 402; 2d, 379; 29th, 373.

Reports were most numerous from: Missouri, 509; Ohio, 411; New Jersey, 325.

Auroras.—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz: June 27 to July 5.

In Canada.—Thunderstorms were reported as follows: Halifax, 15; Yarmouth, 17, 18, 22; Charlottetown, 17, 22; Father Point, 4, 16, 21; Quebec, 2, 10, 15, 16, 18, 21; Montreal, 2, 17, 18; Bissett, 1, 18, 20; Ottawa, 7, 17; Kingston, 1, 6, 18, 21; Toronto, 3, 4, 6, 16, 17, 21, 29; White River, 1, 9, 17, 20, 24; Port Stanley, 11, 16, 22, 26, 29; Saugeen, 5, 10, 21; Parry Sound, 1, 5, 27; Port Arthur, 3, 15, 20, 21, 24; Winnipeg, 13; Minnedosa, 13, 14; Qu'Appelle, 2, 3, 4, 10, 12, 13, 14, 16, 17, 18, 24, 25, 26, 27, 28; Medicine Hat, 3, 25, 26, 27, 28; Calgary, 3, 25, 26, 28; Banff, 2, 8, 9, 20, 26, 27; Edmonton, 3, 10, 16, 19, 24, 26; Prince Albert, 19, 23, 24, 25, 26, 27; Battleford, 6, 10, 13, 17, 20, 23; Barkerville, 18; Hamilton, Bermuda, 20.

Auroras were reported as follows: Quebec, 11.

In Cuba and Porto Rico, weather conditions were generally favorable for the sowing, growth, and harvesting of the various crops.

DESCRIPTION OF TABLES AND CHARTS.

By ALFRED J. HENRY, Professor of Meteorology.

Table I gives, for about 145 Weather Bureau stations making two observations daily and for about 25 others making only one observation, the data ordinarily needed for climatological studies, viz, the monthly mean pressure, the monthly means and extremes of temperature, the average conditions as to moisture, cloudiness, movement of the wind, and the departures from normals in the case of pressure, temperature, and precipitation, the total depth of snowfall, and the mean wet-bulb temperatures. The altitudes of the instruments above ground are also given.

Table II gives, for about 2,700 stations occupied by voluntary observers, the highest maximum and the lowest minimum temperatures, the mean temperature deduced from the average of all the daily maxima and minima, or other readings, as indicated by the numeral following the name of the station; the total monthly precipitation, and the total depth in inches of any snow that may have fallen. When the spaces in the snow column are left blank it indicates that no snow has fallen, but when it is possible that there may have been snow of which no record has been made, that fact is indicated by leaders, thus (. . . .).

Table III gives, for all stations that make observations at

8 a. m. and 8 p. m., the four component directions and the resultant directions based on these two observations only and without considering the velocity of the wind The total movement for the whole month, as read from the dial of the Robinson anemometer, is given for each station in Table I. By adding the four components for the stations comprised in any geographical division the average resultant direction for that division can be obtained.

Table IV gives the total number of stations in each State from which meteorological reports of any kind have been received, and the number of such stations reporting thunderstorms (T) and auroras (A) on each day of the current month.

Table V gives a record of rains whose intensity at some period of the storm's continuance equaled or exceeded the following rates:

Duration, minutes..	5	10	15	20	25	30	35	40	45	50	60	80	100	120
Rates pr. hr. (ins.)..	3.00	1.80	1.40	1.20	1.08	1.00	0.94	0.90	0.86	0.84	0.75	0.60	0.54	0.50

In the northern part of the United States, especially in the colder months of the year, rains of the intensities shown in the above table seldom occur. In all cases where no storm of sufficient intensity to entitle it to a place in the full table has occurred, the greatest rainfall of any single storm has been given, also the greatest hourly fall during that storm.

Table VI gives, for about 30 stations furnished by the Canadian Meteorological Service, Prof. R. F. Stupart, director, the means of pressure and temperature, total precipitation and depth of snowfall, and the respective departures from normal values, except in the case of snowfall.

Table VII gives the heights of rivers referred to zeros of gages.

NOTES EXPLANATORY OF THE CHARTS.

Chart I, tracks of centers of high areas, and Chart II, tracks of centers of low areas, are constructed in the same way. The roman numerals show number and chronological order of highs (Chart I) and lows (Chart II). The figures within the circles show the days of the month; the letters *a* and *p* indicate, respectively, the 8 a. m. and 8 p. m., seventy-fifth meridian time, observations. Within each circle is also given (Chart I) the highest barometric reading and (Chart II) the lowest pressure at or near the center at that time.

Chart III.—Total precipitation. The scale of shades showing the depth of rainfall is given on the chart itself. For isolated stations the rainfall is given in inches and tenths, when appreciable; otherwise, a "trace" is indicated by a capital T, and no rain at all, by 0.0.

Chart IV.—Sea-level pressure, temperature, and resultant surface winds. The wind directions on this Chart are the computed resultants of observations at 8 a. m. and 8 p. m., daily; the resultant duration is shown by figures attached to each arrow. The temperatures are the means of daily maxima and minima and are reduced to sea level. The pressures are the means of 8 a. m. and 8 p. m. observations, daily, and are reduced to sea level and to standard gravity. The reduction for 30 inches of the mercurial barometer, as formerly shown by the marginal figures for each degree of latitude, has already been applied.

Chart V.—Hydrographs for seven principal rivers of the United States.

Chart VI.—Surface temperatures; maximum, minimum, and mean. Lines of equal monthly mean temperature in red; lines of equal maximum temperature in black; and lines of equal minimum temperature (dotted) also in black.

Chart VII.—Percentage of sunshine. The average cloudiness at each Weather Bureau station is determined by numerous personal observations during the day. The difference between the observed cloudiness and 100, it is assumed, represents the percentage of sunshine, and the values thus obtained have been used in preparing Chart VII.

Chart VIII.—West Indian monthly isobars, isotherms, and resultant winds.

Chart IX.—Maximum surface temperatures, July, 1901.

TABLE I.—*Climatological data for Weather Bureau Stations, July, 1901.*

Stations.	Elevation of instruments: Barometer above sea level, feet.	Elevation of instruments: Thermometers above ground.	Elevation of instruments: Anemometer above ground.	Pressure, in inches: Mean actual, 8 a. m. + 8 p. m. ÷ 2.	Pressure, in inches: Mean reduced.	Pressure, in inches: Departure from normal.	Temperature of the air, in degrees Fahrenheit: Mean max. + mean min. ÷ 2.	Temperature: Departure from normal.	Temperature: Maximum.	Temperature: Date.	Temperature: Mean maximum.	Temperature: Minimum.	Temperature: Date.	Temperature: Mean minimum.	Temperature: Greatest daily range.	Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches: Total.	Precipitation: Departure from normal.	Precipitation: Days with .01, or more.	Wind: Total movement, miles.	Wind: Prevailing direction.	Wind: Maximum velocity: Miles per hour.	Wind: Maximum velocity: Direction.	Wind: Maximum velocity: Date.	Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
New England.							69.7	+ 1.9										81	3.02	— 0.4										6.0	
Eastport	76	69	74	29.84	29.93	+ .01	62.6	+ 2.2	93	15	72	46	25	53	35	59	56	80	0.91	— 3.0	9	4,885	sw.	26	sw.	21	9	10	12	6.2	
Portland, Me	103	81	117	29.80	29.90	— .02	69.6	+ 1.1	96	15	78	55	25	62	29	63	60	77	4.21	+ 0.6	16	5,484	s.	25	n.	18	8	8	15	6.2	
Northfield	876	15	65	29.03	29.94	.00	68.0	+ 2.9	94	16	80	42	27	56	36	64	61	79	4.86	+ 1.7	12	5,140	s.	38	n.	18	5	14	12	6.2	
Boston	125	115	181	29.81	29.94	+ .01	73.4	+ 2.1	96	3	82	53	25	65	28	67	64	75	5.20	+ 1.8	12	6,763	sw.	34	sw.	22	8	14	9	5.6	
Nantucket	12	43	85	29.95	29.96	.00	68.8	+ 1.6	86	1	74	56	25	63	20	65	64	88	1.16	— 1.3	9	8,612	sw.	30	w.	2	1	16	14	6.8	
Block Island	26	11	70	29.94	29.97	+ .01	69.3	+ 0.9	86	3	75	55	27	64	19	66	65	90	1.24	— 1.9	11	9,240	sw.	52	nw.	2	4	15	12	6.1	
Narragansett	......	10	......	......	......	......	71.8	+ 1.6	90	1	79	53	27	65	22	....	....	....	2.15	— 1.0	10	......	sw.	....	......	...	21	3	7	....	
New Haven	106	117	140	29.84	29.95	— .01	74.3	+ 2.5	97	2	82	53	27	66	27	68	66	80	4.40	— 0.5	15	5,072	sw.	32	w.	2	12	11	8	4.8	
Mid. Atlan. States.							78.2	+ 3.5										77	3.96	— 0.3										5.5	
Albany	97	84	113	29.84	29.95	+ .03	75.8	+ 3.4	98	2	86	57	27	66	35	68	65	73	4.26	+ 0.3	15	4,812	s.	26	n.	17	9	16	6	5.4	
Binghamton	875	79	90	......	......	......	74.2	+ 5.5	96	21	84	52	20	64	33	....	....	....	3.47	+ 0.2	12	3,476	w.	27	n.	31	6	18	7	5.6	
New York	314	108	350	29.63	29.96	— .01	78.1	+ 4.6	99	2	85	64	27	71	24	70	67	75	5.41	+ 1.2	16	6,748	sw.	66	nw.	31	6	11	14	6.3	
Harrisburg	374	94	104	......	......	......	78.5	+ 5.6	100	1	87	62	26	70	26	....	....	....	1.52	— 2.7	12	4,545	w.	29	nw.	31	7	13	11	5.8	
Philadelphia	117	168	184	29.85	29.97	— .01	79.2	+ 3.5	103	2	87	62	27	71	23	71	68	74	4.88	+ 0.7	16	6,992	sw.	34	n.	29	7	11	13	6.5	
Scranton	805	111	119	29.12	29.96	.00	76.0	......	98	2	86	54	27	66	33	68	64	70	4.12	......	11	4,906	sw.	32	nw.	29	7	13	11	5.9	
Atlantic City	52	68	76	29.91	29.96	.00	75.4	+ 3.5	96	2	81	61	27	70	23	72	70	87	1.89	— 1.5	12	6,570	sw.	36	nw.	6	8	17	6	5.2	
Cape May	17	47	51	29.96	29.98	+ .01	75.6	+ 2.0	94	2	82	61	27	69	27	71	....	....	3.26	— 0.1	9	4,512	sw.	30	w.	6	7	18	6	5.1	
Baltimore	123	68	82	29.83	29.95	— .01	80.4	+ 3.2	103	2	89	64	26	72	27	73	70	76	6.18	+ 1.5	11	3,689	sw.	24	ne.	7	6	15	10	5.6	
Washington	112	59	76	29.85	29.96	— .01	79.8	+ 3.0	102	1	89	64	27	70	27	73	71	79	5.17	+ 0.6	12	3,962	s.	28	nw.	6	12	12	7	4.5	
Cape Henry	......	5	33	......	......	......	80.2	+ 3.2	101	30	88	65	1	72	33	....	....	....	4.06	— 1.6	14	9,099	sw.	70	nw.	31	9	11	11	6.0	
Lynchburg	681	83	88	29.26	29.96	— .02	80.0	+ 2.5	97	1	90	64	10	70	25	72	69	77	4.33	+ 0.4	9	2,701	sw.	24	nw.	16	10	16	5	4.6	
Norfolk	91	102	111	29.89	29.98	— .01	81.0	+ 2.5	100	1	89	68	9	73	27	74	72	80	3.15	— 2.8	14	7,116	s.	36	sw.	8	14	7	10	5.0	
Richmond	144	82	90	......	......	......	81.0	......	99	1	90	64	8	72	27	....	....	....	5.06	......	9	4,216	sw.	26	w.	6	10	11	10	5.5	
S. Atlantic States.							80.9	+ 1.1										80	5.78	— 0.3										5.0	
Charlotte	773	68	76	29.19	29.98	— .02	80.0	+ 1.8	95	30	89	66	8	71	25	72	69	78	6.38	+ 0.8	14	4,539	sw.	30	sw.	15	15	7	9	4.8	
Hatteras	11	17	36	29.99	30.00	.00	78.9	+ 1.0	87	25	83	68	11	75	11	75	74	87	8.17	+ 1.7	10	10,434	sw.	62	w.	11	17	8	6	3.9	
Kittyhawk	8	12	30	......	......	......	81.4	+ 3.4	96	29	87	66	*	76	20	....	....	....	8.40	+ 2.6	10	10,742	sw.	....	......	...	21	4	6	3.7	
Raleigh	376	93	101	29.61	29.99	— .02	80.2	+ 3.1	98	25	89	66	9	71	25	74	72	81	7.14	+ 2.2	15	4,296	sw.	24	se.	13	8	15	8	5.2	
Wilmington	78	82	90	29.92	30.00	.00	79.6	— 0.1	95	25	86	66	9	73	21	75	73	83	8.25	+ 1.0	12	6,271	sw.	30	s.	13	8	11	12	5.3	
Charleston	48	14	92	29.97	30.02	+ .01	81.2	— 0.6	93	26	87	71	10	75	18	75	73	80	5.53	— 2.1	16	6,627	s.	32	sw.	14	6	17	8	5.9	
Columbia	351	114	122	29.65	30.01	+ .01	81.8	+ 1.2	100	25	91	67	14	72	26	73	70	74	2.58	— 3.0	12	5,310	s.	36	sw.	14	9	21	1	4.8	
Augusta	180	89	103	29.81	30.00	.00	82.2	+ 1.1	99	11	91	70	11	73	29	74	71	76	3.44	— 1.8	11	4,003	s.	30	s.	14	11	15	5	4.7	
Savannah	65	79	89	29.95	30.01	— .01	81.4	— 0.5	96	12	89	70	16	74	23	75	73	82	3.69	— 2.1	12	4,763	sw.	26	w.	14	11	11	9	5.1	
Jacksonville	43	69	84	29.97	30.02	+ .01	82.6	+ 0.5	97	12	91	70	1	74	24	75	73	80	4.26	— 2.2	12	5,421	se.	36	e.	12	9	12	10	6.1	
Florida Peninsula.							81.5	— 0.6										80	6.54	+ 0.4										5.6	
Jupiter	28	13	55	29.97	30.00	— .02	81.2	+ 0.4	92	12	86	70	3	76	18	77	75	82	7.22	+ 2.5	18	6,814	se.	30	se.	4	9	19	3	5.0	
Key West	22	43	50	29.95	29.97	— .04	81.4	— 2.5	88	27	86	70	3	77	16	76	74	77	5.58	+ 1.7	16	6,131	e.	26	ne.	2	11	13	7	5.2	
Tampa	34	60	67	29.96	30.00	— .02	81.8	+ 0.4	93	29	90	65	4	74	23	75	73	81	6.82	— 3.0	18	3,407	e.	43	se.	4	1	23	7	6.6	
East Gulf States.							82.1	+ 1.1										75	6.40	+ 0.3										5.0	
Atlanta	1,174	139	156	28.80	30.00	— .04	80.4	+ 2.0	98	26	90	62	9	71	30	71	68	74	5.37	+ 0.5	10	5,017	nw.	37	ne.	26	14	14	3	4.4	
Macon	370	93	99	......	......	......	82.2	......	101	12	92	68	10	72	31	....	....	....	1.15	......	5	3,723	s.	45	sw.	15	7	16	8	5.5	
Pensacola	56	78	90	......	......	......	82.3	+ 1.5	103	12	88	71	14	76	24	....	....	....	6.74	0.0	18	5,623	ne.	32	nw.	15	7	14	10	5.8	
Mobile	57	88	96	29.93	29.99	— .01	82.2	+ 1.0	102	12	90	71	18	74	25	74	72	78	8.95	+ 2.4	17	4,696	sw.	30	sw.	2	11	12	8	5.3	
Montgomery	223	100	112	29.76	29.99	— .02	83.3	+ 1.8	105	12	93	67	17	73	28	73	70	70	1.85	— 2.7	9	3,754	s.	30	n.	17	13	13	5	4.7	
Meridian	375	84	93	......	......	......	81.5	+ 1.5	104	12	93	62	11	70	37	....	....	....	2.94	— 4.0	8	3,072	sw.	32	ne.	2	17	13	1	3.4	
Vicksburg	247	65	76	29.71	29.97	— .03	82.2	+ 0.9	100	13	92	63	9	73	29	74	71	75	3.35	— 1.1	9	3,313	sw.	37	e.	23	10	15	6	4.7	
New Orleans	51	88	121	29.92	29.98	— .01	82.6	+ 0.4	102	13	90	70	18	75	22	75	73	79	10.71	+ 4.2	17	4,842	se.	29	nw.	3	4	15	12	6.2	
Port Eads	......	27	...	......	......	......	82.4	+ 0.1	96	14	88	71	*	76	17	....	....	....	11.29	+ 8.0	14	......	se.	....	......	...	2	17	12	....	
West Gulf States.							83.7	+ 1.9										70	3.16	+ 0.1										4.4	
Shreveport	249	77	84	29.71	29.97	— .02	84.2	+ 1.7	107	13	95	68	9	73	30	73	70	72	4.00	+ 0.5	9	3,905	se.	30	ne.	23	11	10	10	5.0	
Fort Smith	457	79	94	29.47	29.94	— .01	85.1	+ 5.1	106	13	98	66	10	72	36	73	68	64	3.23	— 1.2	10	4,371	e.	49	nw.	15	8	23	0	3.7	
Little Rock	357	93	100	29.59	29.96	— .02	83.8	+ 3.5	106	12	95	65	10	72	33	72	67	66	2.90	— 1.1	10	4,417	sw.	48	nw.	15	15	11	5	3.7	
Corpus Christi	18	42	50	29.91	29.98	— .05	82.4	+ 0.7	90	*	88	74	10	77	14	77	75	80	1.30	0.0	6	8,527	se.	28	w.	10	13	16	2	3.7	
Fort Worth	670	106	114	29.22	29.91	— .04	85.2	......	105	14	97	63	10	74	33	71	65	59	1.99	......	5	7,607	s.	46	w.	19	9	20	2	4.2	
Galveston	54	106	112	29.88	29.93	— .06	83.2	— 0.7	98	13	88	67	14	78	25	77	74	78	6.11	+ 3.0	8	7,462	se.	40	e.	10	7	20	4	5.0	
Palestine	510	73	79	29.42	29.95	— .04	83.4	+ 1.9	101	13	93	69	9	73	27	73	70	72	0.78	— 1.8	5	4,620	s.	26	se.	29	12	16	3	4.7	
San Antonio	701	67	77	29.21	29.92	— .04	84.1	+ 0.8	101	6	94	70	22	74	29	73	69	70	3.79	+ 1.6	6	5,501	se.	42	ne.	10	10	15	6	4.8	
Ohio Val. & Tenn.							81.6	+ 4.6										65	1.66	— 2.4										3.5	
Chattanooga	762	106	112	29.23	30.01	.00	81.8	+ 4.0	100	11	92	64	10	71	31	71	66	67	2.02	— 2.2	9	4,337	sw.	36	se.	15	14	16	1	3.7	
Knoxville	1,004	10	88	28.98	30.01	— .02	80.8	+ 4.4	98	26	92	59	9	69	32	71	67	70	0.69	— 3.6	5	4,642	sw.	32	w.	30	18	10	8	3.5	
Memphis	397	140	154	29.57	29.98	— .01	84.2	+ 3.5	104	23	94	62	9	74	27	72	66	60	0.45	— 3.1	3	5,520	sw.	34	s.	25	19	11	1	3.0	
Nashville	546	128	134	29.42	29.98	.00	83.4	+ 4.1	103	11	94	61	9	73	34	71	65	58	2.59	— 1.7	5	4,239	sw.	29	nw.	30	19	11	1	3.0	
Lexington	989	75	102	......	......	......	80.8	+ 4.6	102	22	91	55	8	69	29	....	....	....	2.61	— 2.5	7	5,881	s.	50	n.	25	23	8	0	2.7	
Louisville	525	114	136	29.42	29.97	— .01	84.2	+ 5.8	107	24	95	59	8	73	31	71	65	57	2.85	— 0.9	4	4,452	s.	30	w.	3	24	6	1	2.0	
Evansville	434	72	82	......	......	......	84.4	......	107	22	95	58	8	74	30	....	....	....	0.18	......	2	4,258	s.	26	w.	4	25	6	0	1.6	
Indianapolis	822	154	164	29.12	29.96	— .03	82.0	+ 5.8	106	22	93	57	8	71	31	69	64	57	0.83	— 3.4	3	6,632	ne.	34	se.	17	19	12	0	2.7	
Cincinnati	628	152	157	29.33	29.98	.00	82.4	+ 5.0	105	22	93	60	8	72	32	70	64	58	1.44	— 1.9	4	4,945	sw.	42	se.	1	16	13	2	3.5	
Columbus	824	87	100	29.12	29.97	— .01	79.9	+ 5.0	104	22	91	56	9	69	32	70	66	67	1.23	— 2.0	8	4,821	sw.	32	s.	1	16	13	2	3.6	
Pittsburg	842	116	123	29.09	29.95	— .03	78.9	+ 3.9	98	1	88	58	8	70	29	70	66	71	2.84	— 1.9	11	3,902	nw.	20	nw.	16	10	15	6	5.1	
Parkersburg	638	77	84	29.34	30.00	+ .01	79.6	+ 4.8	102	27	90	57	9	69	31	71	68	71	0.69	— 3.6	9	3,465	s.	28	nw.	31	10	16	5	4.8	
Elkins	1,940	41	50	28.02	30.00	+ .01	73.8	......	94	21	85	54	9	62	35	67	65	82	2.98	......	13	2,466	sw.	20	w.	3	7	15	9	5.8	
Lower Lake Region.							75.7	+ 4.4										70	3.09	0.0										4.2	
Buffalo	767	178	206	29.14	29.94	.00	73.8	+ 4.1	91	14	80	55	25	68	24	68	65	74	3.05	— 0.1	10	9,166	sw.	40	w.	5	4	22	5	5.8	
Oswego	335	76	87	29.58	29.94	— .02	72.8	+ 3.8	87	28	80	56	27	66	29	66	63	73	3.08	0.0	11	5,833	w.	25	ne.	4	12	13	6	4.6	
Rochester	523	81	90	29.39	29.94	.00	74.4	+ 4.0	96	1	83	56	9	66	30	66	63	70	2.87	— 0.1	16	5,931	sw.	28	sw.	28	11	16	4	4.7	
Erie	713	92	102	29.21	29.94	— .02	75.4	+ 4.4	91	29	82	59	9	69	22	68	65	71	2.27	— 0.5	7	6,902	w.	28	sw.	29	14	15	2	4.1	
Cleveland	762	190	201	29.16	29.95	— .03	76.2	+ 4.7	92	29	83	58	9	69	28	68	65	69	3.77	+ 0.3	10	8,724	s.	51	nw.	11	16	10	5	3.8	
Sandusky	629	62	70	29.30	29.95	— .03	78.4	+ 5.3	98	1	86	59	9	70	29	70	67	71	1.48	— 1.6	8	5,435	sw.	41	nw.	4	15	14	2	3.7	
Toledo	628	123	127	29.31	29.96	— .01	77.5	+ 4.1	97	21	87	57	8	68	26	69	65	68	2.68	— 0.3	9	6,599	sw.	42	se.	2	19	11	1	3.2	
Detroit	730	160	190	29.18	29.94	— .03	76.8	+ 5.2	94	10	86	56	8	67	27	68	63	68	5.50	+ 2.1	12	7,661	sw.	40	sw.	2	18	10	3	3.4	
Upper Lake Region.							71.0	+ 3.7										73	4.37	+ 1.3										5.0	
Alpena	609	63	80	29.30	29.94	— .01	68.6	+ 3.3	98	1	77	52	8	60	35	63	60	74	3.95	+ 1.0	14	6,536	se.	32	n.	20	12	9	10	5.4	
Escanaba	612	43	57	29.29	29.94	+ .01	68.3	+ 1.6	88	16	76	46	8	61	22	64	61	79	7.45	+ 4.2	16	5,972	s.	37	n.	20	8	14	9	5.9	
Grand Haven	632	55	92	29.28	29.93	— .03	74.0	+ 5.2	94	21	83	52	8	66	27	67	63	70	3.90	+ 1.2	11	7,907	s.	38	s.	9	15	12	4	3.8	
Houghton	668	66	74	......	......	......	67.2	......	103	14	77	42	8	58	32	....	....	....	4.54	......	11	5,266	e.	40	w.	1	11	13	7	5.2	
Marquette	734	79	116	29.16	29.93	— .02	68.0	+ 3.1	108	15	76	50	8	60	38	61	58	76	5.96	+ 3.0	11	6,667	nw.	68	sw.	20	7	11	13	6.2	T.
Port Huron	638	70	120	29.30	29.97	+ .02	73.7	+ 5.2	96	1	83	52	9	64	29	66	63	73	2.67	+ 0.3	12	7,320	ne.	35	w.	6	9	12	10	5.5	
Sault Ste. Marie	614	40	61	29.28	29.92	— .04	66.2	+ 4.4	92	15	76	47	8	56	33	61	57	77	4.95	+ 2.0	12	5,179	e.	30	nw.	30	12	11	8	4.9	
Chicago	823	241	274	29.10	29.95	— .02	77.4	+ 5.4	103	21	86	56	7	69	34	68	64	67	4.25	+ 0.8	8	11,231	ne.	56	se.	18	19	10	2	3.2	
Milwaukee	681	124	142	29.24	29.94	— .03	74.7	+ 5.5	100	20	84	54	8	66	31	66	62	68	2.03	— 1.1	8	7,102	n.	42	sw.	1	17	5	9	3.8	
Green Bay	617	49	57	29.29	29.94	— .04	73.7	+ 3.7	99	20	84	50	8	64	31	66	62	70	4.11	+ 1.2	13	5,270	n.	30	sw.	6	8	14	9	6.1	
Duluth	702	95	115	29.19	29.93	+ .01	65.8	— 0.1	98	14	74	48	4	58	36	60	56	75	4.39	+ 0.7	12	6,966	ne.	36	ne.	24	11	11	9	5.4	
North Dakota.							72.2	+ 3.7										74	4.63	+ 1.8										3.7	
Moorhead	935	54	60	28.91	29.89	— .02	72.0	+ 4.4	97	14	82	53	31	62	30	67	64	79	7.94	+ 4.0	12	6,840	se.	37	nw.	28	18	6	7	3.8	
Bismarck	1,674	16	29	28.15	29.86	— .04	73.2	+ 3.7	106	23	84	50	30	62	37	65	61	70	3.24	+ 0.8	10	6,929	e.	48	nw.	4	18	8	5	3.8	
Williston	1,875	15	31	27.98	29.84	— .04	71.5	+ 3.0	99	31	84	47	30	60	37	65	62	74	2.71	+ 0.6	13	6,621	e.	48	w.	13	25	4	2	3.6	

TABLE I.—*Climatological data for Weather Bureau Stations, July, 1901*—Continued.

Stations.	Elevation of instruments: Barometer above sea level, feet.	Elevation of instruments: Thermometers above ground.	Elevation of instruments: Anemometer above ground.	Pressure, in inches: Mean actual, 8 a. m. + 8 p. m. ÷ 2.	Pressure, in inches: Mean reduced.	Pressure, in inches: Departure from normal.	Temperature: Mean max. + mean min. ÷ 2.	Temperature: Departure from normal.	Temperature: Maximum.	Temperature: Date.	Temperature: Mean maximum.	Temperature: Minimum.	Temperature: Date.	Temperature: Mean minimum.	Temperature: Greatest daily range.	Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation: Total.	Precipitation: Departure from normal.	Precipitation: Days with .01, or more.	Wind: Total movement, miles.	Wind: Prevailing direction.	Wind: Maximum velocity: Miles per hour.	Wind: Maximum velocity: Direction.	Wind: Maximum velocity: Date.	Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
Upper Mis. Valley.							82.5	+ 7.3										57	2.41	— 1.3										3.2	
Minneapolis	......	99	208	......	......	......	77.4	+ 5.8	102	20	88	53	7	66	34	....	....	....	1.64	— 2.2	7	8,716	ne.	50	nw.	28	9	18	4	....	
St. Paul	837	114	124	29.01	29.88	— .07	78.0	+ 6.5	104	24	88	53	7	68	30	68	63	65	2.30	— 1.0	8	5,337	se.	36	nw.	1	10	19	2	4.5	
La Crosse	714	70	78	......	......	......	79.2	+ 6.3	104	24	90	52	7	68	34	....	....	....	6.49	+ 2.4	12	4,716	s.	30	w.	25	16	13	2	3.3	
Davenport	606	71	79	29.28	29.91	— .07	83.0	+ 8.0	106	24	95	57	8	71	35	69	61	53	1.48	— 2.2	5	5,151	s.	26	w.	6	25	5	1	1.9	
Des Moines	861	84	88	29.02	29.91	— .05	84.0	+ 9.5	109	22	96	59	8	72	35	70	63	54	1.72	— 1.8	4	5,109	sw.	32	sw.	4	15	15	1	3.5	
Dubuque	698	101	109	29.19	29.91	— .05	82.2	+ 7.9	106	21	94	54	7	70	37	68	61	53	2.31	— 2.0	5	5,535	se.	39	nw.	4	20	8	3	3.1	
Keokuk	614	63	78	29.28	29.91	— .05	85.1	+ 8.2	108	22	97	57	7	74	37	70	64	55	2.02	— 2.1	5	4,879	sw.	24	nw.	6	19	11	1	2.7	
Cairo	356	87	93	29.60	29.97	.00	83.4	+ 4.5	106	23	94	62	8	73	28	73	69	67	4.57	+ 1.1	3	4,060	sw.	34	s.	5	17	11	3	3.0	
Springfield, Ill	644	82	93	29.30	29.95	— .03	82.8	+ 6.8	107	22	95	56	8	71	34	69	63	56	0.58	— 2.2	5	5,726	sw.	39	nw.	30	16	11	4	3.7	
Hannibal	534	75	110	......	......	......	84.8	+ 8.1	108	24	97	59	8	72	35	....	....	....	1.95	— 1.9	7	6,002	sw.	36	sw.	27	19	10	2	3.1	
St. Louis	567	111	210	29.36	29.94	— .03	87.4	+ 8.6	107	24	98	63	8	77	32	70	63	50	1.47	— 2.3	3	6,072	s.	33	nw.	17	16	13	2	3.2	
Missouri Valley.							83.5	+ 8.3										54	2.19	— 1.7										2.8	
Columbia	784	4	84	......	......	......	85.2	+ 8.8	111	12	100	58	6	71	43	....	....	....	2.74	— 2.1	7	4,702	s.	34	ne.	16	16	8	7	3.8	
Kansas City	963	78	95	28.94	29.90	— .05	87.1	+ 9.6	106	22	98	67	6	76	31	70	61	47	2.75	— 1.4	7	5,458	s.	30	w.	4	19	8	4	3.1	
Springfield, Mo	1,324	100	108	28.59	29.93	— .03	83.9	+ 8.2	106	23	95	67	9	73	31	69	62	54	1.69	— 3.1	6	5,940	s.	25	se.	25	20	10	1	2.5	
Topeka	......	81	....	......	......	......	86.6	+ 9.2	106	24	100	60	6	74	38	....	....	....	4.10	— 1.0	9	......	s.	....	......	...	18	11	2	3.0	
Lincoln	1,189	75	84	28.63	29.83	— .11	85.4	+ 8.6	106	21	98	62	7	72	36	69	60	49	2.94	— 1.0	7	7,461	se.	42	w.	27	19	11	1	2.9	
Omaha	1,105	115	121	28.73	29.85	— .09	85.1	+ 8.9	105	24	97	64	5	74	30	70	63	52	2.98	— 1.8	8	5,062	se.	32	sw.	16	20	11	0	2.4	
Valentine	2,598	39	40	27.22	29.81	— .13	79.4	+ 6.1	104	20	93	50	6	66	39	66	59	57	2.38	— 0.1	10	7,634	s.	46	s.	26	22	8	1	2.3	
Sioux City	1,135	96	164	......	......	......	82.6	+ 8.3	106	21	95	58	7	70	34	....	....	....	1.24	— 2.0	6	8,452	se.	38	nw.	28	22	8	1	2.3	
Pierre	1,572	43	50	28.21	29.79	— .12	82.5	+ 7.9	108	20	95	58	6	70	38	68	60	53	1.76	— 0.4	10	7,146	se.	49	nw.	4	17	12	2	3.1	
Huron	1,306	56	67	28.50	29.84	— .10	78.0	+ 7.1	104	12	92	52	30	64	40	67	62	63	0.64	— 2.5	10	8,289	se.	47	nw.	4	19	12	0	2.7	
Yankton	1,233	52	58	......	......	......	82.6	+ 9.0	104	20	96	60	7	70	33	....	....	....	0.84	— 3.0	4	6,024	sw.	36	n.	28	26	5	0	2.5	
Northern Slope.							74.3	+ 4.9										54	1.74	+ 0.1										2.6	
Havre	2,505	46	47	27.28	29.82	— .06	70.9	+ 3.4	97	18	85	42	1	57	44	59	53	60	1.74	— 0.5	8	5,722	ne.	44	nw.	10	22	9	0	2.5	
Miles City	2,371	42	50	27.36	29.74	— .15	78.4	+ 4.7	111	31	93	48	1	64	39	71	68	74	3.54	+ 2.2	8	......	n.	....	......	...	23	7	1	2.4	
Helena	4,110	88	93	25.76	29.81	— .10	70.8	+ 3.6	97	31	84	40	1	58	39	54	42	41	0.40	— 0.7	6	5,536	sw.	38	s.	9	21	7	3	2.8	
Kalispell	2,965	45	51	26.87	29.88	— .04	64.4	......	90	21	80	38	1	48	42	52	43	53	0.34	......	2	4,406	w.	24	sw.	3	27	3	1	1.3	
Rapid City	3,234	46	50	26.56	29.76	— .14	76.3	+ 5.0	101	12	90	53	5	63	41	64	57	55	4.83	+ 3.2	7	5,644	se.	34	nw.	4	19	9	3	2.8	
Cheyenne	6,088	56	64	24.07	29.79	— .08	71.4	+ 4.5	95	20	87	44	5	56	41	56	45	48	1.34	— 0.4	6	6,095	s.	36	s.	22	20	9	2	2.7	
Lander	5,372	28	36	24.66	29.84	— .07	71.5	+ 5.5	99	31	90	37	5	53	48	56	46	47	T.	— 0.8	0	3,204	sw.	36	sw.	9	17	12	2	3.1	
North Platte	2,821	43	52	27.03	29.83	— .08	81.0	+ 7.5	102	20	95	57	6	67	37	67	61	55	0.34	— 2.4	3	6,166	se.	36	w.	10	21	10	0	3.0	
Middle Slope.							82.0	+ 5.8										50	1.34	— 1.5										3.4	
Denver	5,291	79	151	24.76	29.82	— .03	76.6	+ 4.9	99	8	92	55	2	61	38	58	48	46	0.01	— 1.7	1	5,860	sw.	38	n.	27	23	7	1	2.4	
Pueblo	4,685	80	86	25.29	29.83	— .04	77.2	+ 3.2	100	8	93	56	19	61	39	59	50	47	1.04	— 1.1	6	4,918	se.	45	nw.	2	16	15	0	3.3	
Concordia	1,398	42	47	28.45	29.86	— .07	85.8	+ 8.7	104	24	100	60	6	72	38	70	61	49	1.73	— 1.4	6	5,675	s.	26	s.	27	16	12	3	3.7	
Dodge	2,509	44	52	27.36	29.84	— .05	82.4	+ 4.8	104	4	96	61	11	68	37	66	59	53	1.81	— 1.3	4	9,253	se.	56	se.	27	19	11	1	3.7	
Wichita	1,358	78	85	28.53	29.89	— .03	85.4	+ 7.0	104	24	98	64	7	73	32	69	61	52	3.44	+ 0.4	7	5,502	s.	24	s.	27	21	6	4	3.2	
Oklahoma	1,214	54	62	28.66	29.90	— .02	84.9	+ 5.9	102	5	96	66	10	74	33	70	62	53	0.02	— 3.8	1	6,513	s.	25	s.	4	12	14	5	4.0	
Southern Slope.							80.9	+ 1.6										55	0.92	— 1.0										4.0	
Abilene	1,738	45	54	28.14	29.89	— .04	84.6	+ 1.9	101	6	95	67	10	74	28	69	61	53	0.28	— 1.4	3	6,503	se.	31	ne.	12	15	11	5	4.2	
Amarillo	3,676	54	61	26.27	29.88	— .04	77.2	+ 1.2	96	6	88	62	10	66	30	64	57	57	1.56	— 0.6	8	12,002	s.	41	s.	3	15	11	5	3.9	
Southern Plateau.							83.2	+ 0.8										39	0.97	— 0.2										2.9	
El Paso	3,762	10	110	26.13	29.82	— .01	81.1	— 0.8	100	5	93	64	11	69	31	64	55	50	1.05	— 1.0	7	6,983	e.	60	ne.	1	6	19	6	4.8	
Santa Fe	7,013	47	50	23.36	29.90	— .01	69.9	+ 1.4	87	8	80	53	13	59	31	55	46	51	3.37	+ 0.6	15	4,539	se.	29	ne.	18	10	19	2	4.3	
Flagstaff	6,907	12	25	23.40	29.92	......	69.4	......	91	19	84	42	5	54	47	55	...	....	3.02	......	12	......	nw.	....	......	...	10	6	15	....	
Phoenix	1,108	47	57	28.58	29.69	— .08	92.9	+ 3.0	112	9	106	72	5	80	38	68	54	33	0.35	— 0.5	5	3,755	e.	27	n.	24	17	14	0	2.8	
Yuma	141	16	50	29.53	29.67	— .10	91.8	+ 0.3	114	9	105	71	2	78	35	71	61	42	T.	— 0.1	0	5,116	sw.	25	s.	31	27	2	2	1.0	
Independence	3,910	51	58	25.88	29.68	— .10	80.2	— 0.1	99	28	94	54	3	66	36	56	32	20	0.10	0.0	2	5,609	s.	33	n.	22	23	8	0	1.7	
Middle Plateau.							75.8	+ 2.6										31	0.12	— 0.2										2.1	
Carson City	4,720	82	92	25.24	29.85	+ .02	69.4	+ 1.4	97	30	85	41	4	54	46	53	41	41	0.02	— 0.2	1	5,249	w.	36	w.	2	24	5	2	1.4	
Winnemucca	4,344	59	70	25.54	29.75	— .08	71.6	+ 0.2	99	30	90	37	3	53	49	51	32	26	T.	— 0.2	0	6,307	sw.	38	w.	2	24	6	1	1.6	
Modena	5,479	10	38	24.60	29.85	......	74.0	......	98	20	92	46	4	56	50	52	33	32	1.33	......	7	9,136	sw.	43	sw.	10	19	11	1	2.5	
Salt Lake City	4,366	105	110	25.54	29.75	— .10	80.2	+ 4.7	101	18	94	49	5	67	39	56	39	29	0.31	— 0.2	2	4,663	se.	44	sw.	10	19	10	2	2.6	
Grand Junction	4,608	43	50	25.32	29.75	— .10	82.0	+ 4.3	103	18	98	54	5	66	40	58	41	28	0.13	— 0.4	3	3,617	e.	29	se.	20	22	9	0	2.4	
Northern Plateau.							71.5	+ 1.0										41	0.17	— 0.3										2.0	
Baker City	3,471	53	58	26.39	29.87	— .07	66.5	+ 0.5	93	30	81	38	4	52	43	50	36	37	0.02	— 0.6	1	4,453	s.	24	nw.	7	26	1	4	1.8	
Boise	2,739	61	68	27.04	29.79	— .09	74.8	+ 1.7	101	6	92	43	4	57	47	54	37	32	T.	— 0.2	0	2,714	nw.	15	s.	25	24	7	0	1.7	
Lewiston	770	52	61	......	......	......	73.8	......	103	30	89	47	1	58	43	....	....	....	0.63	......	1	3,114	e.	23	nw.	27	26	4	1	1.4	
Pocatello	4,482	48	56	25.41	29.75	— .11	76.4	+ 6.1	102	30	92	40	1	60	48	56	42	35	T.	— 0.4	0	6,660	se.	30	se.	11	24	6	1	2.1	
Spokane	1,943	99	107	27.90	29.90	— .02	67.6	— 1.4	95	30	81	45	3	54	40	53	42	46	0.61	— 0.1	2	3,906	s.	27	s.	3	20	5	6	3.2	
Walla Walla	1,000	65	73	28.86	29.89	— .05	72.0	— 2.0	98	30	86	49	1	58	39	60	52	54	0.23	— 0.1	2	4,361	s.	18	s.	13	25	5	1	2.1	
N. Pac. Coast Reg.							59.1	— 3.0										71	0.60	— 0.3										4.9	
Neah Bay	50	7	52	30.00	30.05	— .02	54.2	— 4.7	62	31	59	45	1	49	14	52	50	87	1.61	— 0.6	10	5,027	w.	28	nw.	23	10	6	15	6.8	
Port Crescent	259	14	20	......	......	......	53.0	— 3.3	65	*	60	38	12	46	23	....	....	....	0.30	— 0.2	6	3,713	w	15	w.	13	8	15	8	5.4	
Seattle	123	114	121	29.92	30.05	— .02	61.6	— 1.6	78	29	71	48	12	53	26	54	49	67	0.35	— 0.3	4	3,351	w.	21	sw.	10	13	13	5	4.4	
Tacoma	213	113	120	......	......	......	60.8	— 1.2	80	29	70	47	12	51	28	....	....	....	0.50	— 0.3	5	4,034	n.	17	w.	13	16	10	5	4.3	
Astoria	20	57	64	......	......	......	57.2	— 4.8	70	28	64	43	15	50	21	....	....	....	1.12	+ 0.1	7	......	nw.	....	......	...	8	18	5	5.3	
Portland, Oreg	154	203	213	29.86	30.02	— .01	62.8	— 3.5	83	29	73	45	4	53	31	56	51	69	0.12	— 0.5	2	5,885	nw.	27	nw.	1	16	11	4	3.9	
Roseburg	518	56	67	29.38	29.98	— .05	64.0	— 2.3	89	29	77	40	4	51	41	54	47	61	0.17	— 0.3	3	3,423	n.	20	n.	26	14	11	6	4.0	
Mid. Pac. C'st Reg.							63.3	— 1.2										59	0.08	0.0										2.5	
Eureka	62	60	69	29.94	30.00	— .05	55.5	— 0.3	69	21	60	48	3	51	14	52	49	83	0.03	— 0.1	2	4,896	nw.	28	nw.	19	15	10	6	4.2	
Mount Tamalpais	2,375	11	18	27.46	29.87	— .08	69.8	......	89	29	78	42	1	62	28	53	37	34	T.	......	0	12,241	nw.	62	nw.	16	29	1	1	0.5	
Red Bluff	332	50	56	29.45	29.79	— .06	81.5	— 0.3	109	26	97	54	3	66	39	60	43	33	T.	0.0	0	3,409	se.	22	s.	2	28	2	1	0.8	
Sacramento	69	106	117	29.73	29.80	— .07	72.6	0.0	100	31	89	47	3	56	43	60	52	56	T.	0.0	0	6,606	sw.	24	sw.	1	29	2	0	0.9	
San Francisco	155	161	167	29.74	29.90	— .04	55.6	— 2.7	75	31	62	47	3	49	25	53	51	90	T.	0.0	0	10,809	sw.	24	sw.	1	18	11	2	2.9	
Point Reyes Light	......	12	16	......	......	......	51.3	— 3.0	72	31	56	43	1	46	23	....	....	....	0.38	+ 0.1	1	16,038	nw.	39	w.	14	12	3	16	5.9	
S. Pac. Coast Reg.							70.6	0.0										65	T.	0.0										2.1	
Fresno	330	67	70	29.43	29.77	— .07	82.0	+ 0.5	108	20	100	50	3	64	41	59	39	29	T.	0.0	0	4,941	nw.	24	nw.	12	29	1	1	0.9	
Los Angeles	338	74	82	29.48	29.84	— .07	70.0	+ 0.7	88	13	82	52	9	58	34	61	57	76	T.	0.0	0	3,487	w.	16	s.	20	12	18	1	2.7	
San Diego	87	94	102	29.73	29.83	— .09	65.8	— 1.3	74	31	70	57	3	62	12	61	59	80	T.	0.0	0	4,016	nw.	20	nw.	6	24	4	3	2.7	
San Luis Obispo	201	10	46	29.68	29.90	— .03	64.8	+ 0.1	90	18	79	44	13	50	40	55	50	68	T.	0.0	0	3,169	w.	16	w.	7	26	3	2	2.2	
West Indies.																															
Basseterre	29	41	54	29.94	29.97	......	80.5	......	87	20	85	71	6	76	14	75	73	78	6.18	......	17	8,277	e.	38	se.	6	7	19	5	5.5	
Bridgetown	30	57	65	29.90	29.93	......	80.4	......	88	25	86	70	27	75	15	76	74	82	13.69	+ 8.6	23	6,482	e.	36	e.	14	12	10	9	5.3	
Cienfuegos	52	62	67	29.90	29.95	......	80.8	......	93	1	89	69	29	73	19	74	73	83	6.41	......	19	4,808	ne.	29	ne.	15	9	18	4	5.0	
Grand Turk	11	6	20	......	......	......	82.2	......	90	30	89	70	29	76	18	....	....	....	4.83	......	15	......	e.	....	......	...	0	15	16	7.0	
Havana	57	87	105	29.90	29.96	......	80.4	......	89	13	87	70	30	74	17	76	75	87	9.09	+ 4.0	15	7,497	e.	48	e.	6	5	21	5	5.5	
Kingston	286	38	52	29.61	29.91	......	79.6	......	90	20	87	70	30	72	16	74	72	80	5.09	......	10	4,082	ne.	24	se.	31	2	23	6	5.8	
Port of Spain	40	65	66	29.88	29.92	......	80.4	......	90	15	87	70	30	74	18	75	72	79	5.48	......	22	3,161	e.	20	e.	25	2	15	14	7.2	
Puerto Principe	352	55	62	29.62	29.96	......	80.2	......	92	25	89	69	29	71	22	74	73	88	11.63	......	21	5,469	ne.	36	e.	20	2	21	8	6.4	
Roseau	25	37	47	29.91	29.93	......	80.4	......	90	30	87	72	6	74	17	74	71	73	19.03	......	28	3,974	ne.	38	e.	2	7	13	11	5.7	
San Juan	82	48	90	29.89	29.97	......	79.8	......	89	25	85	72	6	75	15	75	74	83	10.98	+ 5.2	22	9,596	e.	52	ne.	7	5	13	13	6.2	
Santiago de Cuba	82	26	31	29.84	29.92	......	81.6	......	93	13	90	70	2	73	22	75	73	79	9.82	......	15	2,625	ne.	20	se.	5	11	17	3	4.8	
Santo Domingo	82	37	44	29.92	29.98	......	79.3	......	90	14	86	70	3	72	20	75	74	90	14.11	......	24	4,304	n.	28	e.	1	4	18	9	6.3	
Willemstad	75	39	46	29.79	29.86	......	82.3	......	90	7	87	72	25	77	14	76	74	80	3.23	......	11	8,952	e.	27	e.	3	8	19	4	4.9	

NOTE.—The data at stations having no departures are not used in computing the district averages. *More than one date.

TABLE II.—*Climatological record of voluntary and other cooperating observers, July, 1901.*

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Alabama.	°	°	°	*Ins.*	*Ins.*
Ashville	103	65	81.7	2.51	
Benton	......	......	......	2.48	
Bermuda	108	67	83.4	4.12	
Birmingham	104	64	83.1	5.34	
Burkville	......	......	......	1.11	
Calera	......	......	......	2.54	
Camp Hill	106	......	......	3.42	
Citronelle	106	69	82.4	7.46	
Clanton	100	62	80.2	4.55	
Cordova	105	66	83.1	2.98	
Daphne	104[a]	68[a]	82.2[a]	6.60	
Decatur	107	60	84.5	0.72	
Demopolis	......	......	......	2.67	
Eufaula[a]	103	67	82.9	3.08	
Eutaw	106	68	84.0	3.25	
Evergreen	105	68	82.8	4.53	
Flomaton	104	67	81.7	......	
Florence[a]	......	......	......	0.84	
Fort Deposit	104	69	82.8	1.60	
Gadsden	106	59	82.7	1.44	
Goodwater	101	63	80.4	6.14	
Greensboro	105	66	83.0	3.09	
Greenville	......	......	......	4.01	
Healing Springs	107	66	83.0	1.72	
Helena	......	......	......	2.10	
Highland Home	103	68	79.6	4.80	
Letohatchee	......	......	......	1.04	
Livingston[a]	105	61	83.6	3.27	
Lock No. 4	104	58	81.2	3.79	
Madison Station	104	58	82.2	1.87	
Maplegrove	104	56	81.6	1.32	
Marion	102	69	81.2	1.31	
Mount Willing	104	67	83.2	4.91	
Newbern	104	68	84.0	2.14	
Newburg	103	60	82.1	3.94	
Notasulga	......	......	......	0.35	
Oneonto	99	60	78.8	4.24	
Opelika	99	62	78.6	3.45	
Oxanna	98	60	80.0	5.13	
Pineapple	105	64	83.2	1.65	
Prattville	103	67	81.8	......	
Pushmataha	106	63	82.4	4.29	
Riverton	103	56	81.6	4.72	
Scottsboro	101	66	81.4	1.01	
Selma	105	69	83.3	2.11	
Talladega	103	60	81.8	3.91	
Tallassee	......	......	......	2.40	
Thomasville	105	68	84.0	3.13	
Tuscaloosa	106	61	82.8	2.81	
Tuscumbia	104	61[c]	84.7	1.07	
Tuskegee	104	64	83.0	2.37[c]	
Union Springs	105	69	83.6	2.75	
Uniontown	106	69	83.5	5.60	
Valleyhead	100	58	79.8	8.91	
Verbena	......	......	......	5.50	
Wetumpka	106	68	84.3	1.96	
Alaska.					
Sitka	74	35	54.8	0.45	
Arizona.					
Allaire Ranch	......	......	......	5.15	
Arizona Canal Co. Dam	113	68	92.9	0.79	
Aztec*[5]	116	90	103.2	0.00	
Bisbee	97	58	77.1	3.11	
Buckeye	110	64	89.3	T.	
Casagrande*[1]	112	78	93.4	0.90	
Champie Camp	116	64	90.2	1.80	
Cochise*[5]	98	70	85.8	2.65	
Congress	106	70	88.4	1.27	
Dragoon*[1]	100	65	81.3	2.32	
Duncan	109	52	80.6	2.30	
Fort Apache	102	46	75.2	3.38	
Fort Defiance	97	31	69.2	2.24	
Fort Grant	100	61	80.4	4.37	
Fort Huachuca	99	61	80.0	4.19	
Gilabend*[1]	115	75	92.0	0.60	
Globe	108	63	85.7	2.71	
Ingleside	114	63	92.4	......	
Jerome	103	65	84.2	0.80	
Kingman	106	61	85.6	0.50	
Maricopa*[1]	123	83	102.8	1.50	
Mesa	113	62	89.9	0.48	
Mohawk Summit*[1]	123	84	100.1	0.27	
Mount Huachuca	102	53	79.0	5.39	
Natural Bridge	......	......	......	2.51	
Nogales	104	62	81.8	3.71	
Oracle	101	62	81.3	3.22	
Oro	......	......	......	1.54	
Pantano*[5]	102	64	88.1	6.40	
Parker	117	60	95.2	T.	
Phoenix	114	65	91.4	0.82	
Pima	109	58	85.2	1.84	
Pinal Ranch	......	......	......	3.15	
Prescott	102	37	74.8	3.70	
San Carlos	112	61	88.8	3.24	
Sentinel*[1]	114	87	98.0	T.	
Showlow	......	......	......	2.84	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Arizona—Cont'd.	°	°	°	*Ins.*	*Ins.*
Signal	117	56	92.0	T.	
Silverking	......	......	......	4.79	
Strawberry	98	37	71.4	2.96	
Supai	112	65	86.4	0.50	
Taylor	97	46	72.1	1.29	
Tombstone	103	63	81.1	3.23	
Tonto	113	62	87.4	2.08	
Truxton	104	57	83.2	0.51	
Tuba	101	56	80.2	0.45	
Tucson	108	66	87.3	2.57	
Vail*[5]	105	71	88.6	1.65	
Walnut Grove	......	......	......	0.05	
Willcox*[1]	103	70	84.9	1.13	
Yarnell	......	......	......	2.23	
Arkansas.					
Amity	106	55	81.9	4.90	
Arkadelphia	......	......	......	3.28	
Arkansas City	......	......	......	0.10	
Batesville	111	57	84.8	0.10	
Beebranch	108	55	84.0	2.60	
Blanchard Springs	106	62	83.2	5.22	
Brinkley	110	55	84.4	0.94	
Camden[a]	......	......	......	3.30	
Camden[b]	105	65	84.8	4.69	
Conway	111	52	85.8	0.89	
Corning	111	54	84.0	0.48	
Dallas	107	58	83.9	4.96	
Dardanelle	......	......	......	2.92	
Dutton	104	50	79.8	2.91	
Elon	108	53	81.8	4.89	
Fayetteville	106	60	83.3	1.50	
Forrest City	108	64	85.0	0.49	
Fulton	......	......	......	4.40	
Hardy	109	60	84.6	2.00	
Helena[a]	......	......	......	0.68	
Helena[b]	103	60	83.8	0.56	
Hot Springs[b]	......	......	......	5.97	
Jonesboro	116	60	87.8	2.95	
Keesees Ferry	110	55	84.4	1.55	
Lacrosse	110[c]	60[c]	85.6[c]	3.30	
Lonoke	108	55	83.4	2.18	
Lutherville	104	58	82.4	2.14	
Malvern	110	55	84.4	1.29	
Marianna	106	58[a]	84.4[a]	1.20	
Marvell	110	55	84.4	1.49	
Mossville	101	61	81.4	2.76	
Mount Nebo	......	......	......	2.40	
Newport[a]	......	......	......	1.04	
Newport[b]	112	56	85.0	0.87	
Newport[c]	110	56	83.9	1.10	
Oregon	109	55	83.4	1.91	
Osceola	103	59	84.0	2.16	
Ozark	109	67	86.5	2.29	
Pinebluff	108	57	85.8	0.46	
Pocahontas	111	56	83.6	0.96	
Pond	108	50	83.2	0.95	
Prescott	111	63	85.3	4.28	
Rosadale	110	63	85.3	2.83	
Russellville	106	59	85.0	3.01	
Silversprings	106	57	83.2	1.54	
Spielerville	108	58	84.6	4.39	
Stuttgart	109	57	84.0	1.36	
Texarkana	108	64	85.3	4.33	
Warren	108	53	83.6	3.11	
Washington	106	67	82.6	4.61	
Wiggs	107	53	82.2	3.84	
Winchester	108	56	83.8	1.39	
Winslow	99	63	79.8	2.95	
Witts Springs	110	58	83.4	1.47	
California.					
Angiola	110	46	80.1	0.00	
Bakersfield	110	50	81.8	0.00	
Ballast Point L. H.	......	......	......	0.00	
Bear Valley	......	......	......	T	
Berkeley	80	48	60.8	0.00	
Bishop	99	42	74.6	T.	
Boca*[1]	87	39	62.9	0.00	
Bodie	84	28	57.5	0.39	
Bowman	92	42	69.7	T.	
Branscomb	......	......	......	0.01	
Campbell	95	38	64.2	T.	
Cape Mendocino L. H.	......	......	......	0.00	
Cedarville	94	36	69.4	T.	
Chico*[1]	112	62	82.6	0.00	
Claremont	95	48	72.2	0.00	
Corning*[5]	103	70	82.6	0.00	
Crescent City	67	39	54.0	0.09	
Crescent City L. H.	......	......	......	0.11	
Cuyamaca*[5]	84	49	69.4	T.	
Delano*[1]	110	72	85.0	0.00	
Delta*[1]	102	60	77.6	0.00	
Drytown	105	43	76.0	......	
Dunnigan*[1]	107	70	88.2	0.00	
Durham*[5]	104	55	79.4	T.	
East Brother L. H.	......	......	......	0.00	
Edmanton*[1]	94	40	65.3	0.00	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
Elmdale	114	43	77.1	T.	
Elsinore	106	51	78.0	0.00	
Escondido	102	45	74.2	T.	
Fallbrook	98	48	73.0	0.00	
Folsom City*[1]	105	61	78.2	T	
Fordyce Dam	......	......	......	0.00	
Fort Ross	75	42	57.0	0.00	
Georgetown	100	46	75.7	T.	
Gilroy (near)	99	38	66.2	0.00	
Greenville	99	30	64.4	0.00	
Hanford	106	50	79.2	T.	
Healdsburg	100	37	66.2	T	
Hollister	93	38	63.4	0.00	
Humboldt L. H	......	......	......	0.05	
Idyiwild	......	......	......	0.34	
Indio*[1]	113	82	96.8	0.00	
Iowa Hill*[1]	92	58	74.2	T.	
Irvine	96	60	79.2	T.	
Jackson	97	40	74.1	T.	
Jolon	104	......	......	T.	
Kennedy Gold Mine	97	40	73.0	0.00	
Kernville	......	......	......	0.00	
King City	......	......	......	0.00	
Laguna Valley	......	......	......	1.01	
Lamesa	......	......	......	T.	
Laporte*[1]	90	41	61.9	T.	
Legrand	109	50	79.8	T.	
Lemoncove	108	50	82.2	0.00	
Lick Observatory	87	46[c]	70.1	0.00	
Lime Point L. H.	......	......	......	0.00	
Lodi	101	47	73.7	0.00	
Los Gatos[b]	94	43	66.5	T.	
Mammoth*[1]	115	80	97.0	0.00	
Manzana	102	60	84.2	0.00	
Mare Island L. H	......	......	......	0.00	
Merced[b]	108	46	80.4	T.	
Mills College	......	......	......	0.00	
Milo	......	......	......	T.	
Milton (near)	102	48	77.6	T.	
Mohave*[1]	108	70	85.2	0.00	
Mokelumne Hill*[3]	......	50	73.8	T.	
Monterio	102	56	79.0	T.	
Monterey*[5]	82	50	62.3	0.00	
Morena	......	......	......	0.10	
Mount St. Helena	......	......	......	0.00	
Napa[b]	94	39	64.0	T.	
Needles	113	75	97.7	0.00	
Nevada City	92	38	68.0	T.	
Newhall*[1]	102	60	79.8	0.00	
Niles*[1]	100	56	69.1	T.	
North Bloomfield	100	40	73.0	T.	
North Ontario	92	52	73.3	0.00	
North San Juan*[1]	97	58	73.6	T.	
Oakland[a]	81	47	62.3	0.00	
Ogilby*[5]	118	80	101.2	0.00	
Oleta*[1]	97	54	72.4	0.00	
Orland*[1]	114	63	89.3	0.00	
Palermo	109	47	77.9	0.00	
Palomar Mountain	......	......	......	T.	
Paso Robles	106	44	73.8	0.00	
Peachland*[5]	90	50	66.8	T.	
Piedras Blancas L. H.	......	......	......	0.00	
Pigeon Point L. H.	......	......	......	0.00	
Pilot Creek	......	......	......	T.	
Pine Crest	87	52	68.8	0.15	
Placerville	98	40	70.8	0.00	
Point Ano Nuevo L. H.	......	......	......	0.00	
Point Arena L. H	......	......	......	0.00	
Point Bonita L. H.	......	......	......	0.00	
Point Conception L. H.	......	......	......	0.00	
Point Fermin L. H.	......	......	......	0.00	
Point George L. H.	......	......	......	0.00	
Point Hueneme L. H.	......	......	......	0.00	
Point Lobos	70	47	54.6	T.	
Point Loma L. H.	......	......	......	0.00	
Point Montara L. H.	......	......	......	0.00	
Point Pinos L. H.	......	......	......	0.00	
Point Sur L. H.	......	......	......	0.00	
Pomona (near)	104	50	76.8	0.00	
Poway*[5]	92	52	72.5	T.	
Quincy	95	36	66.1	0.00	
Ranch House	......	......	......	T.	
Redding	104	55	81.1	0.01	
Redlands	104	54	78.4	0.00	
Reedley	108	55	84.4	0.00	
Represa	100	50	75.8	T.	
Roe Island L. H	......	......	......	0.00	
Rohnerville	......	......	......	0.01	
Rosewood	117	47	80.2	0.08	
Sacramento	97	48	73.0	T.	
Salinas*[1]	81	53	62.1	0.00	
Salton*[5]	118	87	104.2	0.00	
San Bernardino	105	46	76.8	0.00	
San Jacinto	106	48	78.8	0.00	
San Jose	......	......	......	0.00	
San Leandro	85	40	62.1	0.00	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
California—Cont'd.	°	°	°	Ins.	Ins.
San Luis L. H				0.00	
San Miguel *[1]	100	53	75.2	0.00	
Santa Barbara	86	52	65.3	0.06	
Santa Barbara L. H				0.00	
Santa Clara				T.	
Santa Cruz	85	36	60.0	T.	
Santa Cruz L. H				0.00	
Santa Maria	86	46	63.4	0.00	
Santa Monica				0.00	
Santa Paula	91	52	71.6	0.00	
Santa Rosa *[1]	92	49	64.4	0.00	
Shasta	110	53	83.6	0.02	
Sierra Madre	91	52	72.6	T.	
Sonoma				T.	
S. E. Farallone L. H				0.05	
Stanford University	89	43	64.0	0.00	
Stockton	96	46	71.8	0.00	
Storey	108	50	79.7	0.00	
Summerdale	88	43	67.0	0.01	
Susanville	102	36	70.9	0.00	
Tehama *[1]	108	63	85.9	0.00	
Tejon Ranch	105	56	83.4	0.00	
Thermalito	106	52	79.4	T.	
Trinidad L. H				0.30	
Truckee *[1]	92	36	54.6	0.00	
Tulare *b*				0.00	
Tulare *c*	112	50	82.0	T.	
Ukiah	104	41	70.3	T.	
Upperlake	102	42	73.2	T.	
Upper Mattole	88	40	61.5	T.	
Vacaville *[1]	104	55	75.0	T.	
Ventura	77	51	63.8	0.00	
Visalia *b*	107	48	79.2	0.00	
Volcano Springs	121	86	102.3	0.00	
Wasco	109	52	83.2	0.00	
Wheatland	102	49	76.2	0.00	
Williams *[5]	103	60	84.4	0.00	
Wilmington *[1]	80	49	64.7	0.00	
Wire Bridge *[5]	102	54	79.9	0.00	
Yerba Buena L. H				0.00	
Yreka	96	36	69.6	0.05	
Yuba City *[5]	102	60	82.2	T.	
Zenia				0.02	
Colorado.					
Alford				0.56	
Amity	102	58	79.8	2.32	
Arkins				0.22	
Ashcroft				1.44	
Bailey	87	37	63.4	1.31	
Blaine	106	49	80.5	1.55	
Boulder	94	53	75.2	0.46	
Boxelder				0.57	
Breckenridge	86	32	59.4	0.89	
Buenavista				0.10	
Canyon	97	53	75.6	1.54	
Castlerock	95	49	72.2	1.72	
Cedaredge	101	46	74.4	0.20	
Cheyenne Wells	103	58	79.0	2.63	
Clearview	79	38	57.4	3.71	
Collbran	99	46	74.4	0.55	
Colorado Springs	91	51	70.8	1.92	
Crook				0.58	
Delta	105	44	77.3	0.05	
Durango	96[d]			0.95	
Fort Collins	97	48	72.5	0.71	
Fort Morgan	99	53	77.0	T.	
Fox				1.54	
Gleneyrie	87	52	70.0	2.00	
Glenwood Springs				0.64	
Greeley	100	50	74.7	0.26	
Grover				0.15	
Gunnison	91	31	64.6	0.42	
Hamps	98	48	73.0	0.38	
Hoehne	96	55	75.1	0.10	
Holly	102	61	80.8	3.43	
Holyoke (near)	106[e]	51[e]	79.4[e]	1.51	
Hugo				0.45	
Husted	92	45	69.2	2.21	
Lake Moraine	82	32	57.6	2.63	
Lamar	108	60	82.4	0.96	
Laporte				0.57	
Las Animas	103	57	80.0	0.00	
Lay	98	27	68.8	0.85	
Leadville (near)				0.82	
Leroy	104	49	78.2	0.97	
Longs Peak	82	35	58.5	0.85	
Mancos	94	40	68.8	0.50	
Meeker	95	33	68.0	0.56	
Montrose				0.17	
Moraine	89	36	63.6	1.43	
Pagoda	98	29	68.0	0.32	
Parachute	104	49	79.3	0.29	
Perrypark				1.14	
Rockyford	103	57	79.1	1.48	
Rogers Mesa	101	47	75.6	0.25	
Russell	85	31	59.8	1.22	
Colorado—Cont'd.					
Saguache	95	45	68.4	0.99	
Salida	96	40	69.3	0.99	
San Luis	89	41	65.4	2.58	
Santa Clara	90	49	66.6	1.72	
Sapinero				0.86	
Seibert				1.73	
Silt	100	48	75.4	0.20	
Sugarloaf	89	45	68.9	2.80	
Telluride	90	35	64.6	0.82	
Trinidad	95	55	74.8	2.37	
T. S. Ranch	95	52	76.9	0.25	
Twinlakes				2.78	
Vilas				2.40	
Wagon Wheel	84	27	56.8	0.80	
Walden	93	30	63.9	0.33	
Wallet				2.04	
Westcliffe	87	40	64.2	0.35	
Wray	103	51	79.2	2.05	
Yuma				1.61	
Connecticut.					
Bridgeport	100	51	75.6	6.41	
Canton	97	48	72.0	3.03	
Colchester	97	50	73.2	6.64	
Falls Village				4.39	
Hartford *b*	98	56	75.6	4.32	
Hawleyville	96	49	74.2	5.64	
Lake Konomoc				2.12	
Middletown	100	50	74.6	4.86	
New London	92	55	76.2	2.38	
North Grosvenor Dale	101	48	72.8	4.32	
Norwalk	100	48	76.0	4.89	
Southington	96	51	73.6	6.30	
South Manchester				6.58	
Storrs	95	51	72.0	5.54	
Voluntown	95	46	73.0	3.96	
Wallingford				2.33	
Waterbury	102	49	77.4	4.44	
West Cornwall	96	52	72.1	4.57	
West Simsbury				2.54	
Delaware.					
Milford	104	63	80.9	4.71	
Millsboro	100	65	80.0	5.24	
Newark	100	59	78.5	3.82	
Seaford	102	66	81.2	3.52	
Wyoming				10.81	
District of Columbia.					
Distributing Reservoir *[5]	98	70	81.2	3.97	
Receiving Reservoir *[5]	95	66	80.6	5.41	
West Washington	102	64	78.8	5.58	
Florida.					
Archer	96	69	81.6	5.74	
Bartow	94	69	81.6	9.86	
Brooksville	95	70	81.4	7.41	
Carrabelle	93	71	81.4	8.18	
Clermont	95	70	82.8	4.52	
De Funiak Springs	105	68	81.1	8.71	
Deland	95	69	81.7		
Earnestville	100	71	83.3	13.35	
Eustis	97	71	83.8	5.93	
Federal Point	94	69	80.6	5.05	
Flamingo	90	71	81.3	7.51	
Fort Meade	97	65	81.6	11.35	
Fort Pierce	95	69	81.1	3.04	
Gainesville	94	70	81.6	7.76	
Huntington	98	68	82.2	3.39	
Hypoluxo	90	70	81.6	4.90	
Inverness	93	69	81.2	8.75	
Jasper				6.66	
Kissimmee	93	69	81.1	2.84	
Lake Butler	95[c]			6.55	
Lake City	98	69	81.6	5.65	
McAlpin	99	69	83.4	3.00	
Macclenny	99[k]	68[l]	82.1[k]	4.10[k]	
Manatee	94	69	81.4	11.12	
Marco	96	72	83.2	9.21	
Marianna	99	69	81.2	4.47	
Merritt Island	92	72	82.4	2.15	
Miami	90	70	81.9	8.18	
Micanopy	97	69	81.9	5.62	
Middleburg	101	66	82.7	6.78	
Myers	90	70	79.5	5.23	
New Smyrna	98[d]	66[c]	80.1[d]	3.20	
Nocatee	97	69	82.4	10.86	
Ocala	98	68	82.5	8.16	
Orange City	98	68	83.0	4.31	
Orlando	93	71	82.0	4.28	
Plant City	98	67	82.0	6.76	
Rockwell	98	69	83.2	5.15	
St. Andrews	96	69	81.5	9.97	
St. Augustine	95	74	82.2	7.33	
Sebastian	93	72	80.8	3.00	
Stephensville *[1]	97	65	80.1	9.69	
Sumner	95	64	80.8	8.18	
Switzerland	96	68	81.1	4.09	
Tallahassee	95	65	80.7	8.25	
Titusville	93	69	81.1	1.62	
Florida—Cont'd.					
Wausau	107	66	83.0	6.10	
Wewahitchka	98	67	81.6	11.42	
Georgia.					
Adairsville[f]	95	63	81.3	2.58	
Albany	104	71	84.4	3.09	
Allapaha	102	67	81.8	4.10	
Allentown	104	67	82.7	4.28	
Americus	102	69	83.3	5.08	
Athens *b*	99	68	80.8	3.51	
Auburn	101			3.41	
Bainbridge	104	70	82.3	3.94	
Blakely	104			4.65	
Bowersville	98	67	81.0	3.90	
Brent	102	66	81.8	4.16	
Camak	100	68	82.4	3.43	
Canton				3.20	
Carlton				3.93	
Clayton	94	61	76.4	1.62	
Columbus	100	72	84.0	5.08	
Covington	104	66	82.1	3.34	
Dahlonega	97	58	79.0	1.97	
Diamond	94	57	76.4	4.07	
Dublin				5.57	
Eastman	104	70	83.8	3.70	
Elberton	97	70	81.5	6.08	
Experiment	99	67	81.2	3.22	
Fitzgerald	102	66	83.1	5.36	
Fleming	100	65	81.0	8.43	
Fort Gaines	104	69	83.2	2.77	
Franklin				6.06	
Gainesville	99	68	79.8	5.47	
Gillsville	102	66	80.3	5.57	
Greenbush	100	55	80.0	3.22	
Griffin	101	64	82.0	3.10	
Harrison	99	67	81.4	5.28	
Hawkinsville	100	71	82.3	2.25	
Hephzibah				4.40	
Jesup	97	69	81.4	8.17	
Lost Mountain	97	62	80.4	4.52	
Lumpkin	105	68	83.9	1.46	
Marshallville	103	68	83.8	2.22	
Milledgeville	97	69	80.8	3.22	
Millen	101	69	83.2	6.40	
Morgan	104	66	80.8	4.14	
Naylor	103	68	82.2	6.90	
Newnan	99	65	82.2	4.55	
Oakdale				1.97	
Point Peter	102	66	81.6	2.84	
Poulan	101	67	80.9	4.89	
Putnam				1.70	
Quitman	105	67	81.7	7.82	
Ramsey	96	53	78.6	3.23	
Resaca				1.25	
Rome	101	58	82.0	4.61	
Statesboro	101	69	82.8	3.10	
Talbotton	101	66	81.4	3.07	
Thomasville	106	70	82.2	10.16	
Toccoa	95	66	79.8	3.76	
Union Point	97	68	80.5	2.89	
Valona	98	98	81.6	5.89	
Vidalia	101	69	83.2	4.15	
Washington	98	69	82.0	4.78	
Waverly	103	68	82.0	13.56	
Waycross	102	69	84.1	3.42	
Waynesboro	98	70	81.2	3.71	
Westpoint	101	68	82.9	3.80	
Woodbury	102	64	81.4	0.88	
Idaho.					
Albion	101	28	69.0	0.21	
American Falls	103	30	73.7	0.00	
Atlanta	95	29	63.4	0.04	
Blackfoot	103	36	74.1	0.23	
Burnside	96	35	70.6	0.20	
Chesterfield	99	18	63.0	0.06	
Downey	102	30	73.2	0.00	
Forney	96	22	63.2	0.35	
Garnet	113	46	82.6	0.00	
Hagerman	109	41	76.6	T.	
Hailey	100	33	69.8	T.	
Idaho City	101	30	68.8	0.00	
Kootenia	91	48	65.6	1.71	
Lake	92	34	62.1	0.40	
Lakeview	90	39	65.0	0.42	
Lost River	99	36	68.0	0.16	
Murray	88	35	61.6	0.38	
Oakley	105	35	73.2	0.10	
Ola	107	38	74.2	0.00	
Payette	106	40	76.6	0.00	
Pollock	104	39	71.1	0.03	
Priest River	91	40	62.1	2.17	
Riddle	100[d]	84[d]	69.0[d]	0.10	
St. Maries	92	37	63.9	0.38	
Soldier	102	25	67.5	0.16	
Swan Valley	102	21	68.1	0.04	
Vernon				0.06	
Weston	104	33	73.0	0.51	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Illinois.	°	°	°	*Ins.*	*Ins.*
Albion	109	55	83.2	3.31	
Aledo	108	55	82.8	2.16	
Alexander	109	50	82.2	1.44	
Antioch	104	45	77.1	2.85	
Ashton	108	45	79.3	4.14	
Astoria	108	48	81.2	2.65	
Aurora *a*	109	47	80.0	4.79	
Bloomington	108	46	82.1	1.96	
Bushnell	111	53	84.4	4.24	
Cambridge	107	53	82.6	3.90	
Carlinville	111	51	83.8	0.72	
Centralia	115	55	86.4	0.95	
Chemung	106	40	78.4	2.45	
Chester	......	......	......	0.32	
Cisne	113	53	84.6	1.58	
Coatsburg	111	57	84.8	2.38	
Cobden	112	57	85.2	1.20	
Danville	104	46	80.0	T.	
Decatur	109	47	81.7	0.49	
Dixon	108	50	81.0	8.98	
Effingham	109	52	82.8	1.32	
Equality	112	54	84.3	2.11	
Flora	108	53	82.8	2.09	
Galva	108	52	80.9	4.59	
Grafton	......	......	......	2.10	
Grayville	106	56	83.7	0.97	
Greenville	113	56	85.8	1.69	
Griggsville	110	55	84.4	2.74	
Halfway	110	56	84.8	0.50	
Halliday	112	51	84.5	0.07	
Havana	109	49	82.6	1.85	
Henry	111	46	82.0	3.40	
Hillsboro	109	54	84.1	1.93	
Joliet	104	48	79.3	5.42	
Kishwaukee	108	42	79.2	4.39	
Knoxville	108	44	80.6	2.51	
Lagrange [g]	104	48	77.1	2.87	
Laharpe	108	50	82.7	5.15	
Lanark	107	41	80.7	1.15	
La Salle	107	50	81.7	4.99	
Loami	......	......	......	0.27	
McLeansboro	110	55	84.6	2.87	
Martinton	106	44	79.5	1.85	
Mascoutah	109	55	83.4	0.76	
Mattoon	106	52	83.4	1.29	
Melrose	109	50	81.6	0.43	
Minonk	106	42	80.2	2.40	
Monmouth	107	47	80.4	5.44	
Monticello	106	51	80.5	0.20	
Morgan Park	......	......	......	5.71	
Morrison	111	49	79.0	6.42	
Morrisonville	110	51	82.0	0.71	
Mount Carmel	......	......	......	0.32	
Mount Pulaski	112	54	83.2	1.67	
Mount Vernon	112	52	85.2	0.69	
New Burnside	112[d]	51[d]	85.4[d]	0.38	
Olney	109	53	84.6	0.25	
Ottawa	112	51	83.3	5.47	
Palestine	105	53	82.2	0.97	
Pana	107	55	82.9	1.08	
Paris	106	52	81.4	2.07	
Peoria *a*	......	......	......	4.39	
Peoria *b*	106	53	82.4	3.97	
Philo	104	47	79.5	3.73	
Plumhill	109	56	84.3	3.17	
Rantoul	106	49	80.7	0.51	
Raum	108	60	85.0	1.96	
Riley	107	47	79.6	3.23	
Robinson	108	50	82.2	0.71	
Rockford	108	50	80.5	2.75	
St. Charles	106	50	81.6	4.72	
Scales Mound	108	44	80.5	2.34	
Shobonier	112	48	83.5	2.95	
Strawn	106	44	80.1	2.37	
Streator	107	47	80.4	3.02	
Sullivan	111	48	82.0	1.43	
Sycamore	106	45	79.2	4.51	
Tilden	111	54	83.9	1.33	
Tiskilwa	108	54	80.9	5.12	
Tuscola	110	48	81.6	1.34	
Walnut	108	52	81.9	3.53	
Wellington	104	57	80.6	1.39	
Winchester	112	55	86.6	1.56	
Winnebago	110	43	80.4	3.76	
Yorkville	106	42	78.8	3.34	
Zion	106	47	80.6	1.53	
Indiana.					
Anderson	104	50	80.6	0.99	
Angola	96	54	76.2	5.95	
Auburn	101	49	78.7	1.38	
Bedford	111	54	84.2	2.02	
Bloomington	108	52	80.7	0.77	
Bluffton	108	49	79.8	1.23	
Bright	108	63	83.4	0.59	
Butlerville	109	50	81.8	0.77	
Cambridge City	106	46	78.7	2.87	
Indiana—Cont'd.					
Columbus	111	49	82.3	1.93	
Connersville	107	49	80.1	8.50	
Crawfordsville	108[b]	66[1]	86.2[e]	0.40	
Delphi	104	48	80.0	0.47	
Edwardsville *[1]	100	56	81.4	2.75	
Farmland	100	50	81.2	2.61	
Franklin *[1]	107	62	81.7	0.81	
Greencastle	105	53	81.4	T.	
Greensburg [d]	102	58	80.0	3.35	
Hammond	104	49	78.0	2.58	
Hector	102	51	79.5	1.41	
Huntington	101	53	80.7	0.91	
Jeffersonville	103	55	82.8	2.58	
Knightstown	107	53	82.8	0.97	
Kokomo	102	55	81.3	0.17	
Lafayette	104	51	81.1	0.44	
Laporte	108	53	80.6	3.36	
Logansport	105	51	81.0	1.09	
Madison *a*	106	52	82.6	0.89	
Madison *b*	......	......	......	1.27	
Marengo	106	51	80.7	1.01	
Marion	105	51	81.1	0.16	
Markle	101	50	78.2	0.20	
Mauzy	108	48	80.2	2.10	
Mount Vernon	109	56	82.9	1.56	
Northfield	103	48	79.8	0.10	
Paoli	111	48	82.8	0.47	
Prairie Creek	110	48	83.2	0.69	
Princeton	111	51	83.1	0.60	
Rensselaer	106	51	81.8	2.40	
Richmond	102	48	78.5	1.49	
Rockville	104	50	80.3	0.31	
Salem	112	49	82.4	0.25	
Scottsburg	109	54	84.6	T.	
Seymour	105	57	82.2	0.30	
Shelbyville	107[b]	60[b]	83.8[b]	1.80	
South Bend	103	51	79.4	2.25	
Syracuse	103	49	79.6	2.70	
Terre Haute	104	54	83.6	0.46	
Topeka	102	51	78.0	0.90	
Valparaiso	104	50	79.8	1.49	
Veedersburg	105	48	80.0	0.39	
Vevay	105	56	83.2	0.40	
Vincennes	109	54	85.4	1.80	
Washington	109	52	83.5	1.43	
Winamac	104[b]	48[b]	81.2[b]	0.50	
Worthington	109	50	81.3	3.11	
Indian Territory.					
Ardmore	109	67	88.1	3.68	
Bengal	107	52	84.2	2.60	
Chickasha	109	59	86.9	0.28	
Claremore	113	57[d]	87.0[b]	0.65	
Fairland	107	57	85.2	1.94	
Hartshorne	108	57	87.0	1.55	
Healdton	108	52	85.8	1.76	
Holdenville	102	61	83.4	5.78	
Lehigh	107	60	85.5	3.20	
Marlow	105	60	85.8	1.06	
Muscogee	108	59	85.6	2.76	
Pauls Valley	106	55	84.8	1.50	
Roff	105[d]	68[d]	87.0[d]	2.46	
Ryan	108	70	88.4	0.90	
Sapulpa	109	57	86.0	1.95	
South McAlester	......	......	......	2.07	
Tahlequah	110	55	85.3	5.51	
Tulsa	......	......	......	0.48	
Wagoner	116	59	89.2	0.75	
Webbers Falls	111[d]	61[d]	87.0[d]	3.00	
Iowa.					
Afton	107	55	82.6	4.42	
Albia	110	55	83.8	2.75	
Algona	106	52	82.2	4.80	
Alta	105	54	81.2	1.55	
Amana	104	52	82.0	1.35	
Ames *b*	109	55	83.3	2.26	
Atlantic	110	51	82.3	1.44	
Battle Creek	......	......	......	0.60	
Baxter	105	54	82.2	2.15	
Belknap	107	58	85.0	2.07	
Belleplaine	104	55	81.6	1.68	
Bonaparte	112	54	84.8	0.94	
Britt	104	48	79.4	4.98	
Buckingham	......	......	......	1.59	
Burlington	107	60	83.6	2.15	
Bussey	......	......	......	2.56	
Carroll	109	54	83.0	0.74	
Cedar Rapids	107	55	83.0	2.74	
Centerville	106	58	85.2	2.09	
Chariton	109	56	83.7	4.25	
Charles City	108	55	81.1	2.65	
Clarinda	110	57	83.6	5.18	
Clearlake	106	52	80.9	3.70	
Clinton	106	49	80.6	4.26	
College Springs	107	59	83.2	5.57	
Columbus Junction	109	58	84.8	1.82	
Corning	106	55	80.7	1.91	
Iowa—Cont'd.	°	°	°	*Ins.*	*Ins.*
Council Bluffs	108	62	85.8	2.11	
Cresco	106	48	78.6	4.08	
Cumberland	......	......	......	1.39	
Danville	......	......	......	2.37	
Decorah	107	48	80.4	3.30	
Delaware	108	49	81.0	1.52	
Denison	106	51	82.4	0.22	
Desoto	......	......	......	1.58	
Dows	106	50	80.5	2.17	
Eldon	112	55	85.1	1.24	
Elkader	111	48	81.8	2.95	
Emerson	......	......	......	1.87	
Estherville	107	50	80.4	1.41	
Fayette	110	48	82.4	0.62	
Fonda	......	......	......	4.38	
Forest City	106	49	82.6	4.00	
Fort Dodge	107	50	81.3	4.82	
Fort Madison	......	......	......	2.19	
Galva	106	54	82.3	0.69	
Gilman	......	......	......	3.51	
Glenwood	106	60	84.8	2.31	
Grand Meadow	108	49	80.8	1.56	
Greene	111	50	82.6	2.84	
Greenfield	106	58	82.4	2.26	
Grinnell (near)	103	56	81.0	1.46	
Grundy Center	105	50	80.2	2.13	
Guthrie Center	106	50	81.8	1.76	
Hampton	100	52	82.4	2.89	
Harlan	111	53	82.4	0.76	
Hawkeye	......	......	......	1.22	
Hopeville	105	59	83.0	1.79	
Hoprig	......	......	......	2.15	
Humboldt	108	51	83.0	2.47	
Independence	106	48	81.2	2.07	
Indianola	109	61	84.6	1.43	
Iowa City	108	53	83.2	1.29	
Iowa Falls	104	51	80.0	3.47	
Jefferson	......	......	......	1.07	
Keosauqua	110	57	85.8	2.79	
Knoxville	109	57	84.7	2.66	
Lacona	......	......	......	3.35	
Larrabee	108	53	82.0	1.13	
Leclaire	......	......	......	4.12	
Lemars	105	52	81.4	2.10	
Lenox	104	59	82.0	1.81	
Logan	110	51	83.4	0.71	
Maple Valley	......	......	......	2.25	
Maquoketa	108	46	80.6	2.15	
Marshalltown	108	54	82.6	2.79	
Monticello	108	......	......	0.59	
Mooar	110	48	79.7	1.96	
Mountayr	109	56	82.9	3.62	
Mount Pleasant	109	50	82.0	2.91	
Mount Vernon *b*	107	57	84.8	0.61	
Murray	......	......	......	4.73	
New Hampton	103[b]	48[c]	79.6[b]	1.82	
Newton	107	57	83.1	2.89	
Northwood	105	49	79.8	1.18	
Odebolt	109	55	84.2	0.30	
Ogden	108	56	82.2	2.41	
Olin [g]	103	51	81.2	1.08	
Onawa	103	56	82.4	0.92	
Osage	101	48	77.8	2.53	
Osceola	107	57	84.1	2.92	
Oskaloosa	107	56	84.0	1.64	
Ottumwa	108	60	86.0	1.98	
Ovid	112	58	85.2	3.08	
Pacific Junction	107	57	83.3	2.68	
Pella	110	60[b]	84.8[b]	2.15	
Perry	110	55	84.1	1.10	
Plover	109	50	81.8	2.27	
Primghar	110	55[f]	83.6[c]	0.85	
Redoak	101	62	83.0	2.80	
Ridgeway	105	52	80.9	5.97	
Rockwell City	106	53	81.4	1.45	
Ruthven	104	50	81.8	2.36	
Sac City	108	54	82.8	0.35	
St. Charles	108	59	83.9	2.42	
Scranton	105	57	82.2	1.12	
Sheldon	104	48	79.6	1.82	
Sibley	106	52	79.5	2.85	
Sigourney	113	51	85.4	1.37	
Spirit Lake	108	52	82.2	0.89	
Storm Lake	104	54	81.5	1.67	
Stuart	108	62	86.1	1.22	
Thurman	102	58	82.7	2.11	
Toledo	109	53	83.3	2.56	
Villisca	104	53	80.6	4.04	
Vinton *[1]	103	57	81.2	4.04	
Wapello	111[b]	56[b]	85.6[b]	1.50	
Washington	106	53	82.0	0.97	
Washta	......	......	......	2.55	
Waterloo	107	51	81.8	3.04	
Waverly	106	53	81.6	1.66	
Westbend	109	50	81.4	3.66	
West Union	......	......	......	3.10	

TABLE II.—*Climatological record of voluntary and other cooperating observers.*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	*Ins.*	*Ins.*
Iowa—Cont'd.					
Whitten	106	53	81.9	2.46	
Wilton Junction	108	50	82.2	3.60	
Winterset	109	58[c]	83.8	4.27	
Woodburn	....	......	......	3.85	
Kansas.					
Abilene	109	60	87.4	0.15	
Achilles	106[b]	55[c]	81.6[c]	0.15	
Altoona	108[c]	56	85.4	3.20	
Anthony	......	......	......	4.54	
Atchison *a*	108	56	86.6	2.13	
Baker	108	58	86.2	0.70	
Beloit	108	61	89.0	0.56	
Burlington	109	54	85.2	2.41	
Chanute	109	59	87.0	0.82	
Colby	106	53	81.6	0.54	
Columbus	110	61	86.2	1.88	
Coolidge	106	44	82.1	2.20	
Delphos	109	54	86.0	1.03	
Dresden	106	54	82.6	0.67	
Ellinwood	104	58	84.1	0.94	
Emporia	106[e]	65[c]	86.0[e]	0.85	
Englewood	105	59	84.6	0.63	
Eureka Ranch	109	51	85.3	1.80	
Fallriver	106	57	84.2	4.03	
Farnsworth *[1]	105	61	81.1	3.50	
Fort Leavenworth	108	64	88.1	1.55	
Fort Scott	112	61	88.4	1.24	
Frankfort	110	54	85.7	3.25	
Garden City	108	57	84.4	1.48	
Gove *[1]	105	65	82.8	1.44	
Grenola	110	55	84.8	0.84	
Hanover	109	61	86.6	1.58	
Harrison	108	56	85.0	2.38	
Hays	110	51	85.0	0.50	
Horton	109	63	87.8	1.80	
Hoxie	108	55	83.6	1.25	
Hutchinson	106	58	84.6	1.54	
Independence	111	65	88.0	2.50	
Jetmore	108	61	83.1	1.30	
Lakin	102	59	80.6	1.50	
Lawrence	108	64	87.0	4.60	
Lebanon	106	54	83.9	2.80	
Lebo	109	57	86.5	2.11	
Leoti	103	58	80.9	2.91	
Little River	107	58	85.4	0.79	
Macksville	103	58	83.2	0.52	
McPherson	110	57	87.6	0.54	
Madison	106	52	82.2	3.38	
Manhattan *c*	111	53	86.4	1.72	
Marion	111[b]	60[e]	86.3[d]	1.85	
Medicine Lodge	109	63[f]	86.2[c]	0.30	
Minneapolis	108	50	85.7	0.36	
Moran	109	65	86.7	0.99	
Mounthope *[1]	104	72	87.7	1.37	
Ness City	109	62	87.3	0.83	
Newton	107	55	85.0	1.44	
Norwich	106	66	85.6	1.84	
Oberlin	......	......	......	0.37	
Olathe	109	58[i]	87.4[f]	3.12	
Osborne	......	......	......	0.75	
Oswego	107	61	85.9	1.84	
Ottawa	110	52	85.4	1.97	
Phillipsburg	......	58	.....	1.66	
Pratt	105	61	84.5	0.63	
Rome	108	61	87.2	4.85	
Russell	105	58	85.2	0.95	
Salina	106	56	86.4	0.20	
Scott	104	52	80.4	3.88	
Sedan	108	58	86.1	3.15	
Seneca	107	57	84.8	3.75	
Toronto	109	56	85.4	4.82	
Tribune	100	45	78.8	2.59	
Ulysses	109	55	82.8	0.54	
Valley Falls	107	55	85.6	2.97	
Viroqua	105	60	82.2	1.60	
Wakeeney (near)	......	......	......	1.20	
Wallace	......	......	......	1.88	
Wamego *[1]	107	63	85.7	4.49	
Winfield	106	60	85.2	2.49	
Yates Center	108	55	84.6	2.34	
Kentucky.					
Alpha	100	60	81.3	2.34	
Anchorage	107	50	81.6	1.12	
Bardstown	108	53	83.4	1.04	
Berea	102	52	80.0	2.73	
Blandville	108	56	83.9	1.80	
Bowling Green	108	54	84.7	0.17	
Burnside	......	......	......	1.98	
Catlettsburg	100	59	80.6	3.54	
Centertown	108	48	82.4	2.41	
Earlington	106	52	82.8	2.55	
Edmonton	106	51	81.2	0.40	
Eubank	103	51	79.1	0.34	
Falmouth	......	......	......	2.34	
Fords Ferry	109	48	80.9	0.71	
Frankfort	100	55	82.4	1.16	
Kentucky—Cont'd.					
Franklin	102	......	......	0.60	
Georgetown	100	52	80.8	......	
Greensburg	107	52	82.7	1.55	
Henderson	107	57	83.6	1.20	
Hopkinsville	109	54	83.7	0.61	
Irvington	100	52	80.7	2.46	
Leitchfield	103	53	80.8	1.12	
Loretto	106[b]	48[c]	80.8[c]	1.06	
Manchester	107	53	81.6	1.05	
Marrowbone	101	50	79.2	1.40	
Maysville	108	53	82.0	0.99	
Mount Sterling	100	53	79.7	2.25	
Owensboro	102	57	82.5	2.49	
Owenton	102	55	82.5	2.29	
Paducah *a*	......	......	......	1.34	
Paducah *b*	112	61	86.4	0.83	
Pikeville	102	58	80.0	1.45	
Richmond	......	......	......	0.30	
St. John	100	55	79.4	1.30	
Scott	107	52	81.1	1.79	
Shelby City	101	51	79.0	2.95	
Shelbyville	107	53	83.0	1.80	
Vanceburg	102	......	......	0.85	
Warfield	96	56	77.8	2.55	
Williamsburg	102	55	80.7	4.32	
Louisiana.					
Abbeville	98	70	81.4	6.87	
Alexandria	109	69	84.7	7.65	
Amite	104	70	83.0	15.83	
Baton Rouge	103	70	82.8	6.38	
Burnside	102	69	81.8	8.29	
Calhoun	107	64	82.2	2.80	
Cheneyville	108	68	84.1	6.37	
Clinton	......	......	......	10.04	
Covington	101	68	81.6	10.80	
Donaldsonville	102	70	81.6	3.76	
Emilie	99	70	81.4	10.79	
Farmerville	103	68	85.1	5.05	
Franklin	100	70	82.4	12.95	
Grand Coteau	104	68	82.6	7.50	
Hammond	106	70	83.4	7.09	
Houma	102	71	83.2	8.75	
Jeanerette	103	71	84.4	9.18	
Jennings	105	69	83.1	5.21	
Lafayette	107	70	83.2	5.97	
Lake Charles	103	71	83.4	6.53	
Lake Providence	100	65	82.2	3.38	
Lawrence	100	71	82.8	10.82	
Libertyhill	111	62	84.7	4.69	
Mansfield	106	57	83.0	3.57	
Melville	102	64	81.8	4.15	
Minden	111	63	84.4	5.67	
Monroe	108	64	84.1	2.82	
New Iberia	101	70	82.4	8.65	
Opelousas	104	69	84.0	9.81	
Oxford	105	59	82.2	3.58	
Paincourtville	102	70	83.0	3.87	
Plain Dealing	108	55	83.4	4.97	
Prevost	......	......	......	2.07	
Rayne	107	70	84.6	5.58	
Reserve	107	69	82.2	9.04	
Robeline	107	60	83.0	3.55	
Ruddock	102	69	82.0	6.62	
Ruston	106	61	83.3	6.41	
Schriever	103	69	82.6	14.30	
Southern University	94	66	77.7	8.96	
Sugar Ex. Station	101	71	82.8	8.82	
Sugartown	102	71	84.2	6.32	
Venice	98	70	81.3	4.95	
Wallace	103	69	82.5	9.87	
White Sulphur Springs	110	67	83.9	5.85	
Maine.					
Bar Harbor	95	48	66.9	1.63	
Belfast	96	48	68.4	3.10	
Bemis	100[d]	42[d]	66.8[d]	5.46	
Calais	94	45	70.4	1.11	
Carmel	97	46	69.0	3.00	
Cornish	97	51	70.6	6.25	
Fairfield	97	45	70.2	2.99	
Farmington	98	41	69.2	4.22	
Flagstaff	94	36	64.8	5.01	
Gardiner	101	48	71.8	4.26	
Kineo	88	43	65.0	1.95	
Lewiston	100	51	71.4	4.25	
Mayfield	94	41	67.2	5.40	
North Bridgton	100	47	70.2	5.13	
Orono	100	40	68.4	2.75	
Rumford Falls	98	45	69.5	4.91	
Winslow	99	42	70.3	3.31	
Maryland.					
Annapolis	105	67	83.0	6.80	
Bachmans Valley	98	59	76.9	8.90	
Boettcherville	103	53	79.1	4.08	
Boonsboro *a*	101	58	78.1	4.65	
Cambridge	100	67	81.5	.....	
Chase	104	62	79.6	6.43	
Maryland—Cont'd.					
Cheltenham	100	64	79.2	5.59	
Chestertown	100	63	79.0	8.48	
Chewsville	100	58	78.0	3.77	
Clearspring	96	57	76.0	3.47	
Coleman	104	....	......	7.42	
Cumberland *b*	......	......	......	2.76	
Darlington	104[b]	61[d]	78.2[c]	9.16	
Deerpark	94	46	71.0	3.33	
Denton	105	62	80.0	7.67[h]	
Easton	99	66	79.8	5.39	
Fallston	100	60	77.8	7.58	
Frederick	101	63	80.2	3.83	
Frostburg	96	52	74.2	5.49	
Grantsville	93	48	73.0	2.63	
Greatfalls	102	......	......	6.05	
Greenspring Furnace	100	57	78.2	4.48	
Hagerstown	102	58	79.3	3.51	
Hancock	106	54	78.6	5.92	
Harney	......	......	......	4.30	
Jewell	100	65	79.2	5.53	
Johns Hopkins Hospital	102	59	78.8	7.10	
Laurel	103	63	79.4	7.49	
Longwoods	......	......	......	6.32	
McDonogh	101	61	78.6	4.50	
Mount St. Marys Coll	99	59	78.4	3.11	
Newmarket	100	61	78.7	6.80	
Pocomoke	100	65	81.2	2.52	
Princess Anne	99	64	79.2	3.10	
Queenstown	100	64	80.4	4.66	
Rockhall *b*	102	64	79.4	8.31	
Sharpsburg	105	64	82.7	4.73	
Smithsburg *a*	100	55	77.6	2.53	
Smithsburg *b*	100	58	77.8	3.42	
Solomons	99	66	81.0	7.14	
Sudlersville	104	63	80.4	8.01	
Sunnyside	96	40	71.4	5.42	
Takoma Park	98	63	78.2	6.68	
Taneytown	99	62	78.0	7.50	
Van Bibber	101	63	79.0	6.80	
Westernport	98	52	76.4	2.11	
Woodstock	100	63	80.6	4.93	
Massachusetts.					
Amherst	97	49	72.8	3.77	
Bedford	92	50	71.6	6.00	
Bluehill (summit)	93	51	71.5	6.15	
Cambridge	96	53	74.0	4.06	
Chestnuthill	97	52	75.0	6.40	
Cohasset	......	......	......	9.69	
Concord	97	49	72.5	5.15	
East Templeton *[1]	98	54	72.6	3.08	
Fallriver	92	56	72.6	2.13	
Fitchburg *a* *[1]	96	55	72.8	5.13	
Fitchburg *b*	100	52	73.4	6.03	
Framingham	99	51	74.5	5.19	
Groton	96	47	71.4	6.13	
Hyannis	......	......	......	3.40	
Jefferson	......	......	......	5.55	
Lawrence	95	52	73.4	4.15	
Leominster	......	......	......	6.31	
Lowell *a*	95	53	75.8	4.78	
Lowell *b*	96	50	74.4	......	
Ludlow Center	97	48	70.1	3.37	
Middleboro	92	47	71.7	2.58	
Monson	96	52	74.4	3.50	
New Bedford *a*	90	54	71.5	3.22	
Pittsfield	96	49	73.6	3.30	
Plymouth *[1]	92	55	71.5	4.44	
Princeton	......	......	......	5.56	
Provincetown	104	52	73.4	3.82	
Salem	......	......	......	3.48	
Somerset *[1]	100	54	76.8	5.02	
Springfield Armory	100	52	74.7	5.11	
Sterling	......	......	......	5.51	
Taunton	92	45	71.8	3.94	
Webster	......	......	......	4.20	
Westboro	98	52	74.4	6.37	
Weston	94	50	72.8	5.76	
Williamstown	91	48	70.2	5.78	
Winchendon	......	......	......	4.53	
Worcester	97	51	74.3	4.30	
Michigan.					
Adrian	98	49	77.3	1.75	
Agricultural College	98	49	74.2	5.08	
Allegan	96[d]	48[d]	76.4[d]	1.92	
Alma	98	49	75.5	4.45	
Ann Arbor	97	51	76.6	3.35	
Annpere	98	......	......	1.95	
Arbela	96	48	74.0	4.00	
Baldwin	100	45	75.4	1.48	
Ball Mountain	97	48	75.4	3.53	
Battlecreek	98	50	76.8	3.44	
Bay City	98	52	75.0	4.38	
Benzonia	94	46	72.4	2.70	
Berlin	96	47	74.2	2.81	
Berrien Springs	104	60	80.2	2.00	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Michigan—Cont'd.	°	°	°	*Ins.*	*Ins.*
Big Rapids	97	44	73.4	4.80	
Birmingham	98	50	77.2	2.33	
Boon	94	40	68.8	5.56	
Calumet	97	40	65.9	4.71	
Carsonville	96	45	75.6	4.19	
Cassopolis	102	37	77.6	2.85	
Charlevoix	98	49	70.2	7.00	
Chatham	98	31	67.4	5.23	
Cheboygan	96	49	69.8	4.61	
Clinton	96	50	77.0	3.59	
Coldwater	98	51	76.6	4.67	
Deerpark	97	45	65.0	3.81	
Detour	92	51	67.8	5.78	
Dundee	96	50	77.4	2.96	
Eagle Harbor	100	41	62.8	3.36	
East Tawas	97	53	72.0	3.37	
Eloise	98	49	76.8	4.57	
Ewen	101	41	67.0	2.00	
Fairview	94	51	76.4	3.47	
Fennville	100	49	77.0	1.32	
Fitchburg	95	40	74.1	5.21	
Flint	97	48	74.8	3.89	
Gaylord	101	37	68.6	8.85	
Gladwin	96	41	72.6	4.70	
Grand Marais	98	41	67.2	4.62	
Grand Rapids	97	52	78.1	5.12	
Grape	100	48	77.5	1.96	
Grayling	99	42	71.9	3.38	
Hanover	96	31	76.8	3.08	
Harbor Beach	101	50	73.0	2.41	
Harrison	97	48	74.0	4.46	
Harrisville	103	52	70.0	3.50	
Hart	98	44	75.1	2.42	
Hastings	100	46	76.2	6.19	
Hayes	98	47	71.6	4.83	
Highland Station	......	......	......	3.39	
Hillsdale	96	48	76.0	2.68	
Humboldt	98	29	65.2	5.25	
Ionia	98	49	77.2	3.61	
Iron River	96	34	69.2	10.40	
Ishpeming	97	31	68.0	5.11	
Ivan	97	42	71.0	3.78	
Jackson	100	51	78.6	2.90	
Jeddo	101	49	74.1	3.59	
Kalamazoo	100	51	78.4	3.31	
Lake City	99	45	74.1	3.20	
Lansing	95	50	74.9	6.33	
Lapeer	97	44	75.1	3.92	
Lathrop	96	48	71.4	9.15	
Lincoln	97	49	70.4	3.22	
Ludington	98	......	......	1.97	
Mackinac Island	87	45	67.6	4.30	
Mackinaw	96	50	70.9	6.63	
Madison	99	50	78.0	2.49	
Mancelona	99	43	72.0	4.72	
Manistee	95	53	73.6	4.62	
Manistique	89	43	66.7	5.28	
Menominee	99	46	70.2	4.64	
Midland	99	47	74.4		
Mio	98	44	71.2	2.97	
Mount Clemens	103	48	76.2	3.12	
Mount Pleasant	98	40	74.4	3.10	
Muskegon	95	55	76.1	6.67	
Newberry	94	......	......	2.40	
North Marshall[4]	98	48	75.2	4.00	
Old Mission	96	50	73.2	3.77	
Olivet	94	52	75.6	7.33	
Omer	98	38	70.6	4.69	
Onaway	97	36	69.0	5.42	
Ontonagon	99	40	63.6	7.27	
Ovid	96	50	74.4	5.34	
Owosso	99	50	78.2	4.95	
Petoskey	98	48	69.0	4.85	
Plymouth	100	50	77.4	......	
Port Austin	100	56	75.9	3.10	
Reed City	97	49	76.2	3.84	
Roscommon	......	......	......	3.40	
Saginaw	99	49	75.6	4.76	
St. Ignace	92	46	65.6	4.02	
St. Joseph	100	52	78.3	2.40	
Sidnaw	100	40	67.8	4.20	
Somerset	95	49	75.6	2.60	
South Haven	98	51	74.4	1.75	
Stanton[4]	100	49	78.0	3.53	
Thomaston	101	44	67.6	3.10	
Thornville	97	52	75.6	3.25	
Traverse City	100	55	73.2	3.97	
Vassar	94	42	73.8	9.09	
Wasepi	97	53	76.2	3.06	
Waverly	100	30	75.7	2.95	
West Branch	98	44	70.4	2.53	
Wetmore	99[c]	33[c]	63.4[c]	7.55	
Whitecloud	98	45	76.0	......	
Whitefish Point	93	45	62.6	6.00	
Williamston	94	50	76.3	5.35	
Ypsilanti	96	48	75.6	3.88	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Minnesota.	°	°	°	*Ins.*	*Ins.*
Ada	97	46	71.6	4.69	
Alexandria	100	50	73.1	2.44	
Ashby	98	53	73.4	3.73	
Beardsley	106[1]	50[c]	75.4[c]	2.25	
Beauliew	95	40	72.2	4.45	
Bemidji	101	52	72.4	7.84	
Bird Island	105	48	76.7	1.41	
Blooming Prairie	103	46	77.4	1.70	
Brainerd	90[c]	51[c]	73.7[c]	4.69	
Caledonia	103	52	77.2	8.10	
Collegeville	103	53	74.7	2.53	
Crookston	99	54	71.6	4.61	
Currie	108	44	77.7	......	
Deephaven	......	......	......	1.52	
Detroit City	97	46	71.6	5.45	
Faribault	104	49	79.6	3.48	
Farmington	102	48	76.8	2.32	
Fergus Falls	100	50	73.6	6.48	
Glencoe	103	40	75.1	2.71	
Grand Marais	......	......	......	4.38	
Grand Meadow	107	45	79.4	2.68	
Hallock	93	45	69.0	3.77	
Hovland	......	......	......	4.38	
Lake Jennie	102	52	75.3	2.68	
Lakeside	105	51	76.0	1.59	
Lake Winnibigoshish	103	48	70.4	3.82	
Leech	99	48	70.2	5.20	
Long Prairie	102	47	73.8	4.86	
Laverne	102	54	79.0	1.46	
Lynd	104	50	76.8	0.88	
Mapleplain	104	47	76.2	2.53	
Milaca	100	43	72.2	3.20	
Milan	107	50	78.2	1.15	
Minneapolis *b*[1]	105*	48	77.2	1.41	
Montevideo	106	49	77.9	1.24	
Morris	102	54	75.4	2.34	
Mount Iron	101	40	68.0	4.17	
Newfolden	95	47	68.6	12.08	
New London	110	52	78.2	1.62	
New Richland*[1]	103	60	79.2	......	
New Ulm	105	54	79.8	2.07	
Park Rapids	100	48	70.4	4.91	
Pine River	98	49	70.6	3.38	
Pipestone	100	56	78.4	0.85	
Pleasant Mounds	102	50	78.4	1.29	
Pokegama Falls	99	40	68.8	5.09	
Redwing *a*	......	......	......	1.94	
Redwing *b*	106	50	79.0	1.83	
Reeds	......	......	......	2.72	
Rolling Green	99	51	78.2	2.67	
St. Charles	104	51	77.0	5.10	
St. Cloud	105	50	76.6	2.38	
St. Peter	106	47	79.0	1.12	
Sandy Lake Dam	98	49	71.0	2.69	
Shakopee	102	50	76.4	1.76	
Thief River Falls	......	......	......	3.24	
Tower	101	35	68.7	3.00	
Two Harbors	99	44	63.8	4.91	
Wabasha*[3]	105	55	75.2	3.70	
Warroad	97[b]	46[b]	69.4[b]	1.63	
White Bear	99	......	......	2.38	
Willmar	102	49	75.1	2.23	
Willow River	101	42	69.8	5.53	
Worthington	100	53	79.0	1.70	
Wyoming	......	......	......	3.07	
Zumbrota[1]	103*	52	77.9	......	
Mississippi.					
Aberdeen	105	52	81.8	3.99	
Agricultural College	105	63	85.1	0.60	
Austin	101	57	82.3	3.60	
Batesville	107	53	84.0	1.18	
Bay St. Louis	101	72	82.9	10.55	
Biloxi	100	70	82.7	11.48	
Booneville	104	58	82.9	1.69	
Brookhaven	109	66	83.8	3.25	
Canton	103	59	81.9	4.49	
Cleveland	105	56	81.2	2.10	
Columbus *a*	......	......	......	3.11	
Columbus *b*	102	63	83.4	3.12	
Corinth	104	60	83.8	1.58	
Crystalsprings	105	66	83.0	3.39	
Edwards	102	67	84.5	1.84	
Fayette	104	67	82.2	4.70	
Fayette (near)*[1]	105	74	84.8	3.53	
Greenville *a*	98	65	83.2	2.23	
Greenville *b*	105	64	84.6	2.25	
Hattiesburg	101	72	85.0	8.68	
Hazlehurst	106	61	83.1	3.48	
Hernando	104	61	85.0	0.25	
Holly Springs	103	61	84.4	1.57	
Indianola	102	55	81.4	3.75	
Jackson	104	65	83.0	3.22	
Kosciusko	106	61	83.4	2.90	
Lake	103	59	79.6	1.02	
Leakesville	109	64	83.5	4.29	
Louisville	104	61	82.7	2.69	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Mississippi—Cont'd.	°	°	°	*Ins.*	*Ins.*
Macon	105	60	83.6	0.62	
Magnolia	104	68	81.9	11.11	
Natchez	105	70	83.0	8.55	
Nittayuma	104	60	83.1	5.89	
Okolona	108	55	84.4	0.97	
Palo Alto	104	62	84.6	0.85	
Pearlington	105	69	82.6	5.63	
Pittsboro	107	57	83.6	2.62	
Pontotoc	105	57	83.4	2.08	
Poplarville	101[c]	72[c]	83.2[c]	10.38	
Port Gibson	103	61	82.8	5.24	
Ripley	105	56	82.1	0.81	
Saratoga	106	60	82.1	5.70	
Shoccoe	......	......	......	3.25	
Stonington*[1]	100	68	81.4	4.86	
Suffolk	104	67	81.4	7.59	
Swartwout	108	......	......	6.90	
Thornton	100	58	84.8	3.30	
Tupelo	......	......	......	3.23	
Walnutgrove	104	70[g]	84.2[c]	2.19	
Watervalley	108	62	85.3	1.87	
Waynesboro	105	69	84.7	3.82	
Windham	110	62	81.6	5.80	
Woodville	104	69	82.8	10.25	
Yazoo City	105	62	83.4	2.40	
Missouri.					
Appleton City	110[c]	61	86.7[c]	1.21	
Arthur	110	53	86.1	2.78	
Avalon	111	59	87.1	1.46	
Bethany	109	52	83.0	3.16	
Birchtree	109	56	82.6	2.50	
Boonville	......	......	......	1.75	
Brunswick	103	62	84.1	1.82	
Carrollton	108	64	87.1	1.92	
Conception	104	65	86.4	0.91	
Cook Station	115	48	83.9	1.85	
Cowgill*[5]	108	66	88.8	2.46	
Darksville	112	61	85.8	3.85	
Dean	111	56	84.2	3.51	
Desoto	110	52	85.0	0.60	
Downing	......	......	......	2.15	
Edgehill*[5]	110	62	84.4	1.32	
Edwards	111	52	84.8	2.93	
Eightmile*[3]	114	60	80.3	1.51	
Eldon	110	53	85.1	0.68	
Fairport	......	......	......	1.78	
Fayette	113	60	86.4	1.72	
Fulton	110	52	84.0	1.41	
Galena	......	......	......	3.30	
Gallatin*[1]	112	63	87.3	1.55	
Gayoso	107	59	84.4	2.62	
Glasgow	109	59	86.2	1.26	
Gorin	......	......	......	2.85	
Halfway	109[g]	57[g]	84.6[g]	2.66	
Harrisonville	112	57	87.6	1.92	
Hazlehurst	......	......	......	1.00	
Hermann	......	......	......	1.39	
Houston	111	51	82.4	1.65	
Irena	......	......	......	3.86	
Ironton	113	50	82.8	2.42	
Jackson	111	50	82.8	2.05	
Jefferson City	114	59	87.0	1.06	
Kidder	109	59	85.8	3.14	
Koshkonong	110	62	84.7	2.80	
Lamar	108	59	86.0	1.95	
Lamonte	......	......	......	2.82	
Lebanon	109	61	85.4	1.80	
Lexington	111	60	86.9	3.54	
Liberty	109	55	85.8	1.97	
McCune*[1]	110	62	85.7	2.51	
Macon	111	58	86.6	3.50	
Marblehill	116[c]	53[d]	84.4[d]	1.81	
Marshall	108	60	85.1	1.54	
Maryville	107	60	84.2	4.85	
Mexico	112	57	86.6	2.06	
Miami*[5]	109	70	89.4	2.19	
Mineralspring	107	60	84.6	0.42	
Montreal	110	56	84.4	1.99	
Mountaingrove	107	61[c]	83.5[c]	2.63	
Mount Vernon	111	59	87.4	0.05	
Neosho	106	54	83.1	3.05	
Nevada	......	......	......	1.72	
New Haven	112	58	86.0	1.82	
New Madrid *a*	106	60	85.2	......	
New Madrid *b*	......	......	......	2.96	
New Palestine	110	60	86.2	0.92	
Oakfield	112	60	87.2	0.49	
Olden	106	59	82.8	1.18	
Oregon *a*	107	61	85.9	2.52	
Palmyra*[5]	107	64	86.6	3.22	
Phillipsburg*[1]	109[g]	72[g]	83.7[g]	1.67	
Pine Hill	......	......	......	2.80	
Poplarbluff	112	53	85.1	0.71	
Potosi	112	46	81.9	1.48	
Princeton	111	63	87.0	1.61	
Richmond	108	65	86.2	2.37	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	Ins.	Ins.
***Missouri*—Cont'd.**					
Rockport	......	......	......	1.98	
Rolla	......	......	......	1.64	
St. Charles	112	54	86.2	0.75	
St. Joseph	......	......	......	1.18	
Sarcoxie *3	......	74	83.0	1.83	
Seymour	107	61	83.4	1.30	
Shelbina	......	......	......	4.90	
Sikeston	111	53	83.2	0.73	
Steffenville	112	56	86.2	1.83	
Sublett	112	54	85.6	0.82	
Trenton	105	62	85.5	1.98	
Unionville	112	60	86.7	0.77	
Vichy	112	55	85.0	3.39	
Warrensburg	110	60	87.1	2.00	
Warrenton	113	60	87.4	1.33	
Wheatland	......	......	......	1.60	
Willowsprings	107	51	80.3	1.19	
Windsor	......	60	......	1.28	
Zeitonia	111	51	83.8	1.46	
Montana.					
Adel	90	25	60.4	1.33	
Anaconda	96	37	66.3	T.	
Augusta	91	33	64.6	0.38	
Billings	112	46	77.8	......	
Boulder	97	32	66.8	......	
Butte	92	33	65.4	0.55	
Canyon Ferry	104	37	74.0	0.51	
Chester	98	35	68.1	0.01	
Chinook	104	46	75.0	2.08	
Clemons	90	30	62.8	0.37	
Corvallis	100	33	72.4	0.00	
Crow Agency	101	37	74.4	0.40	
Culbertson	104	45	72.6	1.66	
Deerlodge k	108	......	......	1.75	
Dell	100	30	67.6	T.	
Dillon	93	36	71.5	0.24	
Fort Benton	96	41	71.0	0.95	
Fort Logan	94	32	65.4	0.70	
Glasgow	105	42	71.9	1.73	
Glendive	110	50	75.4	3.65	
Glenwood	96	32	66.6	0.19	
Greatfalls	95	42	70.8	1.39	
Kipp	92	32	59.8	0.18	
Lewistown	97	34	68.1	2.00	
Livingston	106	42	73.3	0.30	
Manhattan	102e	29e	69.6e	T.	
Martinsdale	102	32	68.4	1.00	
Marysville	94	40	67.5	0.71	
Ovando	96	28	61.4	0.03	
Parrot	103	37	71.0	0.39	
Plains	95	36	65.6	0.15	
Poplar	106	42	75.2	1.23	
Ridgelawn	104	46	73.0	2.81	
St. Pauls	95	38	69.5	1.75	
St. Peter	90	28	62.4	1.33	
Troy	94	36	60.5	0.53	
Utica	102	37	69.1	1.97	
Wibaux	105	42	70.4	3.63	
Yale	99	34	68.2	0.16	
Nebraska.					
Agate	......	......	......	2.15	
Agee *1	109	64	83.1	1.15	
Albion	102	52	80.2	0.31	
Alliance	101	46	78.1	0.20	
Alma	110	49	84.4	0.64	
Ansley *	105	47	80.4	0.66	
Arapahoe	......	......	......	0.60	
Arborville *1	110	67	84.3	0.94	
Arcadia	......	......	......	4.50	
Arlington	......	......	......	2.92	
Ashland *a*	109	58	85.8	5.63	
Ashland *b* *1	112	68	88.3	6.24	
Ashton	......	......	......	1.05	
Auburn	109	57	86.1	2.42	
Aurora	104	......	......	1.79	
Bartley	......	......	......	1.08	
Beatrice	108	57	85.4	4.02	
Beaver	110	53	86.4	1.30	
Bellevue	......	......	......	2.26	
Benedict	......	......	......	1.69	
Blair	106	59	83.2	1.83	
Bluehill *1	106	60	86.4	1.84	
Bradshaw		......	......	2.01	
Brokenbow *1	102	52	77.7	1.15	
Burchard	......	......	......	4.45	
Burwell	......	......	......	0.87	
Callaway	104	59	81.0	1.33	
Camp Clarke	106	45	78.8	1.31	
Central City	......	......	......	3.40	
Chester	......	......	......	1.90	
Cody	......	......	......	0.70	
Columbus	103	53	82.0	1.33	
Crete	105	62	84.6	4.46	
Culbertson	......	......	......	0.25	
Curtis	105	49	81.6	0.20	
Dannebrog	......	......	......	1.79	
***Nebraska*—Cont'd.**					
David City	106	60	83.8	2.90	
Dawson	111	58	87.6	1.22	
Eden	......	......	......	2.81	
Edgar *a*	......	......	......	6.06	
Ericson	......	......	......	0.22	
Ewing	......	......	......	0.69	
Fairbury	110	57	85.4	3.89	
Fairfield	107	58	85.2	2.83	
Fairmont	104	58	83.2	7.19	
Fort Robinson	102	48	76.5	1.52	
Franklin	106	......	......	2.12	
Fremont	105	56	82.0	2.11	
Fullerton	......	......	......	0.90	
Geneva	108	59	84.1	4.77	
Genoa	106	58	84.0	0.50	
Gering	105	49	78.7	1.20	
Gordon	......	......	......	2.80	
Gosper	......	......	......	0.78	
Gothenburg	105	51	79.7	0.40	
Grand Island *a* *1	102	66	85.6	1.85	
Grand Island *b*	108	60	86.5	1.62	
Grand Island *c*	111	57	86.2	0.74	
Greeley	......	......	......	0.20	
Guide Rock	......	......	......	1.38	
Haigler	......	......	......	1.66	
Hartington	106	53	82.1	0.56	
Harvard	106	56	84.0	1.84	
Hastings *1	105	68	86.3	3.25	
Hayes Center	......	......	......	0.58	
Hay Springs	102	47	76.2	1.66	
Hebron	108	57	84.6	2.59	
Hickman	......	......	......	4.65	
Holbrook	......	......	......	0.15	
Holdrege	......	......	......	0.50	
Hooper *1	104	66	82.8	3.75	
Imperial	106	52	80.6	1.50	
Johnstown	......	......	......	0.28	
Kearney	106	54	84.6	2.05	
Kennedy	108	47	82.0	0.39	
Kimball	103	48	76.4	2.04	
Kirkwood *1	104	62	80.0	0.97	
Laclede	107	57	84.0	1.72	
Lena	......	......	......	1.16	
Lexington	103	54	80.7	0.87	
Lodgepole	99	48	76.2	0.75	
Loup	......	......	......	1.54	
Lynch	104	48	79.3	2.01	
Lyons	......	......	......	1.32	
McCook *1	104	68	86.2	0.40	
McCool	......	......	......	4.81	
Madison	102f	56f	82.6f	......	
Madrid	......	......	......	0.31	
Marquette	......	......	......	2.39	
Mason City	......	......	......	1.00	
Minden *a*	104	54	83.3	1.37	
Monroe	......	......	......	0.58	
Nebraska City *b* *1	104	70	87.5	2.67	
Nebraska City *c*	105	66k	85.6k	2.35	
Nemaha *1	110	70	89.3	1.52	
Nesbit	104	46	78.0	0.83	
Norfolk	108	52	82.8	0.67	
North Loup	104	57	82.4	1.86	
Oakdale	105	52	81.6	1.02	
Odell	......	......	......	2.27	
O'Neill	104	53	81.4	0.05	
Ord	......	......	......	1.76	
Osceola	......	......	......	2.36	
Ough	......	......	......	1.35	
Palmer	......	......	......	1.50	
Palmyra *1	110	66	84.2	2.71	
Plattsmouth *a*	......	......	......	3.22	
Plattsmouth *b*	107	51	83.0	3.22	
Pleasanthill	......	......	......	3.99	
Ravenna *a*	105	55	83.0	2.37	
Ravenna *b*	......	......	......	2.02	
Redcloud *b*	106	55	84.2	2.30	
Republican *1	108	70	88.5	0.20	
St. Libory	......	......	......	2.70	
St. Paul	106	56	82.6	0.84	
Salem *1	105	74	87.8	1.22	
Santee	106h	54h	83.4h	0.52	
Schuyler	......	......	......	3.45	
Seneca *1	102	52	73.6	0.52	
Seward	106	60	84.8	4.42	
Smithfield	......	......	......	0.65	
Spragg	......	......	......	1.36	
Springview	107	52	80.6	0.92	
State Farm	109	58	85.0	2.91	
Strang	......	......	......	4.91	
Stratton	......	......	......	2.15	
Superior	107	61	86.0	2.20	
Syracuse	......	......	......	1.92	
Tablerock	......	......	......	3.67	
Tecumseh *b*	110	57	85.2	2.75	
Tecumseh *c*	......	......	......	2.88	
Tekamah	106	59	82.6	2.39	
***Nebraska*—Cont'd.**					
Turlington	107	60	85.0	2.07	
Wakefield	107	54	81.4	0.94	
Wallace	......	......	......	0.00	
Wauneta	......	......	......	1.20	
Weeping Water	......	......	......	2.49	
Westpoint	109	55	84.7	0.85	
Whitman	......	......	......	2.15	
Wilber *1	108	60	83.2	2.11	
Willard	......	......	......	0.58	
Wilsonville	......	......	......	0.76	
Winnebago	......	......	......	1.67	
Wisner	......	......	......	1.39	
Wymore	......	......	......	3.00	
York	106	60	85.4	5.55	
Nevada.					
Amos	100	31	69.8	......	
Austin	92	42	72.2e	0.51	
Belmont	93	43	70.4	0.36	
Beowawe *1	104	63	81.5	T.	
Candelaria	101	49	78.1	0.10	
Carlin *1	102	50	71.8	0.80	
Carson City	97	35	68.3	T.	
Elko (near)	98	30	67.1	0.50	
Ely	97	38	71.0	0.36	
Fenelon *1	100	48	74.0	T.	
Golconda *1	100	60	82.8	0.00	
Halleck *1	109	49	72.6	0.00	
Hamilton	93f	40f	66.4f	T.f	
Hawthorne	101	51	77.8	0.10	
Hot Springs *1	109	70	87.2	0.00	
Humboldt *1	95	56	76.8	0.00	
Lee	......	......	......	0.58	
Lewers Ranch	100	38	69.6	T.	
Lovelocks *a*	......	......	......	0.00	
Lovelocks *b*	100	33	70.4	0.00	
Martins	102	36	69.6	0.00	
Monitor Mill	92	34	70.1	1.00	
Owyhee	99	33	68.4	0.50	
Palisade *1	104	51	78.8	0.32	
Palmetto	95	33	68.3	1.19	
Potts	100	40	69.4	0.76	
Reno State University	97	36	70.4	T.	
Sodaville	104	......	......	T.	
Tecoma *1	110	50	75.2	0.00	
Toano *5	112	42	84.5	T.	
Tybo	102	47	75.2	0.25	
Verdi *1	92	42	62.0	0.00	
Wadsworth *1	106	66	85.5	0.00	
Wells *1	99	66	79.1	0.00	
Wood	94	39	68.7	0.06	
New Hampshire.					
Alstead	93	46	71.2	5.68	
Berlin Mills	97	38	67.9	3.95	
Bethlehem	92	43	68.2	4.94	
Brookline *1	99	58	74.3	4.46	
Ch tham	97	44	68.8	4.39	
Claremont	98	48	72.4	4.24	
Concord	97	46	71.9	4.51	
Durham	97	50	71.8	3.10	
Franklin Falls	94	51	71.8	4.04	
Grafton	96	42	69.2	5.30	
Hanover	96	45	70.8	5.13	
Keene	98	46	71.6	5.65	
Littleton	94	42	68.4	5.75	
Nashua	99	47	73.9	2.91	
Newton	94	46	70.6	3.25	
Peterboro	98	43	71.5	4.20	
Plymouth	99	47	71.1	6.79	
Sanbornton	95	49	69.8	4.81	
Stratford	97	41	68.7	4.40	
New Jersey.					
Asbury Park	95	60	75.7	4.38	
Bayonne	104	58	78.0	5.20	
Belvidere	102	56	78.2	3.66	
Bergen Point	103	60	77.0	6.33	
Beverly	106	57	78.8	7.39	
Blairstown	104	55	76.8	4.37	
Bridgeton	104	60	78.3	5.13	
Cape May C. H.	102	58	79.2	3.27	
Charlotteburg	98	45	73.6	7.32	
Chester	100	55	75.0	9.00	
Clayton	104	57	78.8	3.57	
College Farm	105	55	77.4	9.12	
Dover	103	50	76.0	10.92	
Egg Harbor City	104	55	77.8	3.67	
Elizabeth	105	56	77.8	6.36	
Englewood	101	58	77.2	4.74	
Flemington	105	55	78.6	7.04	
Freehold	102g	55g	75.4g	6.11g	
Friesburg	105	58	79.0	5.51	
Hanover	102	51	75.6	6.71	
Hightstown	102	57	77.0	8.69	
Imlaystown	101	58	78.4	3.38	
Indian Mills	107	61	80.3	5.05	
Lakewood	99	56	76.5	3.81	
Lambertville	103	56	78.3	5.33	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
New Jersey—Cont'd.	°	°	°	*Ins.*	*Ins.*
Layton	101	41	75.4	7.44	
Moorestown	102	57	77.9	5.53	
Mount Pleasant	......	......	......	3.84	
Newark	102	54	76.7	4.89	
New Brunswick	106	57	78.6	8.33	
New Egypt	......	......	......	3.79	
Newton	100	52	77.0	8.90	
Oceanic	99	58	75.4	8.27	
Paterson	102	56	77.4	9.86	
Perth Amboy	106	59	77.8	8.41	
Plainfield	104	54	77.4	5.96	
Rancocas	......	......	......	5.30	
Rivervale	103	49	75.8	6.57	
Roseland	102	50	75.2	8.05	
Salem	107	59	80.0	5.17	
Somerville	107	53	78.6	6.15	
South Orange	101	54	76.8	5.68	
Sussex	100	52	76.4	6.82	
Three Bridges	......	......	......	6.79	
Toms River	100	52	76.6	4.83	
Trenton	100	60	78.6	6.60	
Tuckerton	101	55	77.2	4.27	
Vineland	105	57	79.0	4.55	
Woodbine	......	57	......	2.13	
Woodstown	......	......	......	4.81	
New Mexico.					
Alamagordo	107	58	82.6	1.47	
Albert	102	59	77.6	3.21	
Albuquerque	99	59	77.3	1.46	
Alma	99	51	75.4	4.87	
Aztec	100[f]	52[f]	80.9[f]	0.09[f]	
Bellranch	......	......	......	4.83	
Bluewater	102	40	74.0	2.50	
Cambray	......	......	......	2.02	
Carlsbad	102	60	80.2	2.86	
Deming	......	......	......	0.98	
Dolores	......	......	......	3.06	
East Lasvegas	85	57	70.5	3.70	
Engle	99	63[e]	77.4[e]	2.47	
Espanola	98	53	74.6	1.54	
Folsom	89	49	70.2	0.66	
Fort Bayard	95	50	72.8	2.10	
Fort Union	92	48	68.9	2.78	
Fort Wingate	98	48	74.5	0.92	
Gage	......	......	......	3.05	
Galisteo	98	52	74.4	1.55	
Gallinas Spring	98	56	76.8	3.77	
Horse Springs	96	48	70.8	3.27	
Las Vegas	95	42	71.2	4.24	
Las Vegas Hotsprings	89	50	67.6	5.42	
Lordsburg	......	......	......	2.30	
Lower Penasco	......	56	......	6.68	
Mesilla Park	105	57	79.7	2.23	
Olio	105	46	79.7	T.	
Raton	92	52	70.4	2.30	
Roswell	100	55	77.8	3.04	
San Marcial	110	54	79.4	0.02	
Socorro	102	59	80.8	1.98	
Springer	97	49	71.9	4.98	
Strauss	......	......	......	4.11	
Woodbury	98	51	74.8	3.84	
New York.					
Adams	......	......	......	4.36	
Addison	98	52	75.0	2.01	
Adirondack Lodge	88	39	66.2	7.32	
Akron	......	......	......	4.00	
Alden	94	51	73.9	2.62	
Angelica	95	42	72.2	3.34	
Appleton	95	51	73.4	3.62	
Arcade	92	40	70.9	2.96	
Atlanta	94	48	72.1	7.59	
Atwell	89	49	68.6	6.34	
Auburn	99	52	77.0	2.12	
Avon	95	50	74.4	3.23	
Axton	92	34	65.4	4.51	
Baldwinsville	99[d]	54[d]	77.4[d]	3.69	
Bedford *a*	102	51	75.8	5.52	
Blue Mountain Lake	......	......	......	6.30	
Bolivar	96	46	71.5	4.75	
Bouckville	91	51	72.2	3.54	
Boyds Corners	......	......	......	7.07	
Brockport	93	50	74.2	4.29	
Caldwell	92	52	71.0	4.41	
Canaan Four Corners	94	50	71.9	4.08	
Canajoharie	94	52	72.8	4.55	
Canton	95	45	70.5	2.98	
Carmel	97	56	75.6	8.52	
Carvers Falls	97	50	71.9	4.38	
Catskill	99	54	75.2	3.10	
Cedarhill	97	52	74.8	4.34	
Chenango Forks	......	......	......	4.25	
Cooperstown	91	52	71.6	6.79	
Cortland	......	......	......	3.49	
Cutchogue	94	53	73.8	3.32	
Dekalb Junction	......	......	......	3.12	
Easton	......	......	......	6.88	
New York—Cont'd.	°	°	°	*Ins.*	*Ins.*
Elba	94	52	74.1	4.49	
Elmira	101	55	76.7	4.23	
Fayetteville	94	54	75.8	3.12	
Franklinville	93	43	71.3	3.61	
Fulton	......	......	......	2.57	
Gabriels	91	43	66.6	5.47	
Glens Falls	96	54	73.6	4.39	
Gloversville	94	50	72.8	3.49	
Greenwich	95	51	72.8	5.67	
Griffin Corners	94	44	71.6	3.63	
Haskinville	......	......	......	3.31	
Hemlock	92	51	74.6	2.07	
Honnedaga Lake	......	......	......	7.37	
Humphrey	92	47	70.4	8.55	
Indian Lake	91	42	68.8	4.65	
Ithaca	95	52	74.3	3.60	
Jay	100	42	70.2	3.84	
Keene Valley	97	44	70.0	5.68	
King Ferry	......	......	......	2.40	
King Station	......	......	......	6.30	
Liberty	......	......	......	5.40	
Littlefalls, City Res.	91	50	73.0	3.74	
Lockport	......	......	......	4.00	
Lowville	92	46	71.6	5.00	
Lyndonville	......	......	......	3.61	
Lyons	97[d]	56[f]	76.3[e]	1.79	
Mayle	......	......	......	2.79	
Meredith	92	49	71.1	3.54	
Middletown	97	57	76.6	5.52	
Mohonk Lake	92	54	72.8	4.46	
Moira	94	42	70.0	3.13	
Newark Valley	......	......	......	3.56	
New Lisbon	91	44	70.0	3.68	
New Rochelle	102	50	75.2	7.78	
North Hammond	92	50	72.1	3.87	
Number Four	91	41	68.6	4.67	
Ogdensburg	92	53	71.4	3.72	
Old Chatham	......	......	......	4.46	
Oneonta	97	49	74.2	3.85	
Oxford	93	48	72.8	3.93	
Palermo	......	......	......	3.66	
Penn Yan	96	54	76.6	1.93	
Perry City	97	47	73.5	5.39	
Plattsburg Barracks	99	47	72.4	3.18	
Port Byron	94	52	74.2	2.76	
Port Jervis	103	55	76.8	7.33	
Primrose	104	52	76.5	9.63	
Redhook	......	......	......	4.12	
Richmondville	92	50	72.6	7.24	
Ridgeway	91	50	74.2	5.07	
Rome	94	52	73.1	3.75	
Romulus	95	53	75.5	4.10	
Salisbury Mills	......	......	......	4.10	
Saranac Lake	94	41	68.0	4.10	
Saratoga Springs	93	52	73.6	4.12	
Schenectady	97	55	76.0	5.15	
Scottsville	......	......	......	4.23	
Setauket	98	54	73.8	3.42	
Shortsville	94	52	74.0	4.62	
Skaneateles	......	......	......	3.36	
Southampton	91	53	72.8	4.13	
South Berlin	......	......	......	3.60	
South Canisteo	93	45	71.4	3.97	
Southeast Res.	......	......	......	8.30	
South Schroon	92	46	69.0	5.38	
Straits Corners	95	47	73.4	4.40	
Ticonderoga	94	50	72.6	4.56	
Volusia	90	53	72.8	2.01	
Walton	97	41	72.4	4.83	
Wappingers Falls	99	56	76.9	7.58	
Warwick	......	......	......	5.27	
Watertown	94	50	73.0	3.75	
Waverly	99	49	75.2	3.35	
Wedgwood	93	53	73.2	2.84	
Wells	96	45	71.4	5.56	
West Berne	94	47	72.8	5.87	
West Chazy	96	41	70.8	......	
Westfield *a*	92	55	75.4	2.51	
Westfield *b*	91	56	74.4	1.82	
Westfield *c*	90	55	75.4	1.82	
Windham	95	46	72.5	3.64	
Wolcott	......	......	......	3.47	
North Carolina.					
Abshers	98	59	77.7	5.81	
Asheville	......	......	......	4.91	
Biltmore	91	62	73.6	2.99	
Bryson City	......	......	......	4.09	
Chapelhill	99	65	81.2	6.12	
Cherryville	100	66	79.1	3.17	
Currituck	......	......	......	3.57	
Edenton	99	65	81.6	......	
Fayetteville	96	66	80.1	7.81	
Flatrock	92	55	73.8	4.05	
Goldsboro	95	65	80.7	8.45	
Greensboro	94	65	78.6	5.70	
Henderson	98	64	79.6	6.40	
North Carolina—Cont'd.	°	°	°	*Ins.*	*Ins.*
Hendersonville	94	57	75.0	5.22	
Henrietta	95	66	79.8	4.86	
Highlands	84	54	68.4	7.76	
Horse Cove	88	60	72.6	8.16	
Kinston	100	66	82.1	6.25	
Lenoir	96[1]	61[1]	78.4[1]	1.61[1]	
Linville	85	49	68.4	......	
Littleton	101	63	79.6	7.36	
Louisburg	97	67	80.8	7.37	
Lumberton	97	68	81.6	6.54	
Marion	97	61	78.2	3.00	
Marshall	......	......	......	2.92	
Mocksville	95	64	78.8	3.81	
Moncure	95	64	79.8	7.71	
Monroe	95	60	78.7	3.50	
Morganton	98	61	78.2	1.30	
Mountairy	94	61	77.6	4.78	
Murphy	......	......	......	1.23	
Newbern	97	65	80.6	9.16	
Oakridge	97	62	78.9	9.39	
Patterson *[1]	96	60	73.6	2.29	
Pittsboro	98	65	80.6	7.39	
Redsprings	99	66	80.8	11.27	
Rockingham	95	61	80.1	9.41	
Roxboro	97	64	79.8	5.72	
Salem	97	64	79.8	7.75	
Salisbury	98	64	78.0	4.34	
Saxon	95	60	79.0	6.79	
Selma	101	65	81.2	9.10	
Settle	96	64	80.4	9.04	
Sloan	94	65	78.8	12.82	
Soapstone Mount	95	63	77.8	7.57	
Southern Pines *a*	100	63	82.2	13.23	
Southern Pines *b*	97	65	80.5	12.64	
Southport	92	69	81.0	8.51	
Springhope *[1]	97	70	80.4	6.42	
Statesville	96	62	78.0	2.17	
Tarboro	104	67	82.2	8.24	
Washington	105	66	83.1	6.18	
Waynesville	90	51	71.6	2.94	
Weldon *a*	96	68	80.4	7.48	
Weldon *b*	......	......	......	7.55	
North Dakota.					
Amenia	......	......	......	5.91	
Ashley	106	40	73.0	2.70	
Berlin	104	46	71.4	4.19	
Cando	91	45	65.0	5.00	
Churchs Ferry	94	49	68.2	4.58	
Coalharbor	103	49	71.2	5.08	
Devils Lake	97	49	69.5	4.23	
Dickinson	108	45	74.0	3.69	
Donnybrook	......	......	......	2.82	
Dunseith	91	42	67.2	4.31	
Edgeley	105	52	73.0	5.03	
Ellendale	104	50	74.4	4.83	
Falconer	107	48	73.3	3.09	
Fargo	96	48	71.4	7.29	
Forman	101	50	73.2	4.37	
Fort Berthold	107	46	74.0	5.31	
Fort Yates	110	46	76.2	1.13	
Fullerton	105	48	72.2	3.51	
Gallatin	96	42	70.0	3.40	
Grafton	98	51	70.9	3.55	
Hamilton	93	49	68.3	3.24	
Hannaford	97	50	69.2	6.72	
Jamestown	102	51	66.9	4.95	
Larimore	96	50	67.5	3.38	
McKinney	100	45	68.0	2.55	
Mayville	101	50	72.0	4.03	
Medora	108	47	75.4	2.96	
Melville	98	51	70.5	6.74	
Milton	88	48	64.0	5.23	
Minnewaukon [4]	99	49	71.1	4.46	
Minto	98	47	68.9	3.83	
Napoleon	105	48	73.4	3.16	
New England	104	45	72.0	2.75	
Oakdale	98	47	70.4	3.04	
Pembina	94	45	68.4	3.03	
Portal	93	46	68.4	2.89	
Power	101	41	71.2	8.14	
Steele	104	49	72.4	5.65	
University	94	50	69.0	4.18	
Valley City	100	49	73.0	5.88	
Wahpeton	100	48	71.9	7.35	
Willow City	94	44	67.4	5.70	
Woodbridge	92	44	66.4	2.22	
Ohio.					
Akron	97	53	76.6	3.77	
Ashtabula	96	56	75.0	1.50	
Atwater	......	......	......	2.18	
Bangorville	100	54	77.8	3.68	
Belfast	......	......	......	1.51	
Bellefontaine	100	53	77.7	1.33	
Bement	......	......	......	4.18	
Benton Ridge	98	51	78.0	2.66	
Bethany	108	50	81.8	1.35	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Ohio—Cont'd.	°	°	°	*Ins.*	*Ins.*
Binola	......	......	......	4.00	
Bloomingburg	106	52	80.0	1.82	
Bowling Green	98	50	76.4	4.42	
Bucyrus	103	53	78.0	3.20	
Cambridge	98	52[d]	78.0	3.62	
Camp Dennison	109	50	80.8	1.32	
Canaan	......	......	......	1.97	
Canal Dover	102	52	78.0	2.03	
Canton	97	53	77.6	2.38	
Cardington	98	51	76.7	2.05	
Cedarville	......	......	......	1.66	
Celina	100	52	77.8	3.24	
Chillicothe	108	52	81.4	2.07	
Circleville	102	54	79.0	1.39	
Clarksville	104	52	79.8	3.34	
Cleveland *a*	93	56	76.2	4.50	
Cleveland *b*	97	56	77.7	4.41	
Clifton	103	50	78.4	1.44	
Coalton	101	51	78.4	3.10	
Colebrook	95	50	74.6	3.99	
Dayton *a*	......	......	......	1.33	
Dayton *b*	108	50	80.7	1.33	
Defiance	100	51	78.8	6.08	
Delaware	102	50	77.8	3.31	
Demos	97	54	77.0	3.61	
Elyria	101	53	77.2	3.10	
Findlay	104	50	80.4	1.36	
Frankfort	100	50	77.4	2.06	
Fremont	97	54	78.2	2.92	
Garrettsville	97	49	75.6	3.31	
Granville	101	50	78.1	3.21	
Gratiot	97	54	77.8	2.42	
Green	99	53	79.2	2.60	
Greenfield	103	54	79.5	1.70	
Greenhill	95	50	75.0	4.28	
Greenville	101	52	78.6	1.33	
Hanging Rock	103	54	79.5	2.88	
Hedges	102	55	79.0	1.89	
Hillhouse	94	50	74.4	5.11	
Hillsboro	102	51	78.4	2.35	
Hiram	95	55	76.5	3.71	
Hudson	100	50	76.5	3.31	
Jacksonboro	109	58	82.2	0.55	
Killbuck	98	52	76.4	2.69	
Lancaster	99	52	77.6	2.10	
Leipsic	......	......	......	3.20	
Lima	100	48	78.0	1.16	
McConnelsville	98	54	78.1	5.40	
Manara	100	50	78.4	3.39	
Mansfield	......	......	......	5.23	
Marietta	98	57	79.2	2.92	
Marion	102	50	79.6	1.52	
Medina	96	51	76.8	4.11	
Milfordton	99	50	77.2	1.48	
Milligan	100	50	77.7	1.54	
Millport	95	51	76.7	2.03	
Montpelier	98	52	76.8	5.07	
Moorfield	100	53	77.4	2.84	
Napoleon	97	53	77.6	2.98	
New Alexandria	100	54	78.6	2.95	
New Berlin	97	53	77.2	3.43	
New Bremen	102	50	79.8	1.68	
New Lexington	......	......	......	2.95	
New Paris	104	56	80.6	0.71	
New Richmond	108	54	81.9	2.00	
New Waterford	94	54	76.4	2.65	
North Lewisburg	103	50	78.2	1.85	
North Royalton	99	51	77.1	4.12	
Norwalk	102	51	77.9	2.48	
Oberlin	98	51	77.5	2.45	
Ohio State University	103	50	78.1	0.82	
Orangeville	97	48	74.2	2.75	
Ottawa	102	50	78.8	3.32	
Pataskala	101	50	77.0	2.81	
Philo	99	53	78.7	2.55	
Plattsburg	103	50	78.4	6.62	
Pomeroy	102	55	80.2	0.98	
Portsmouth *a*	......	......	......	4.02	
Portsmouth *b*	102	56	81.2	4.02	
Pulse	......	......	......	1.49	
Red Lion	......	......	......	2.74	
Richfield	......	......	......	3.18	
Richwood	102	49	78.6	4.83	
Ripley	103	52	80.1	0.59	
Rittman	95	51	76.2	2.79	
Rock	......	......	......	1.51	
Rockyridge	100	52	77.9	2.26	
Rosewood	105	49	78.5	1.14	
Shenandoah	97	50	76.2	2.98	
Sidney	108	50	81.3	2.36	
Sinking Spring	106	50	80.5	1.70	
Somerset	101	54	79.6	1.98	
Springfield	......	......	......	2.81	
Strongsville	......	......	......	3.15	
Swanton	......	......	......	3.71	
Thurman	103	52	79.6	1.10	
Ohio—Cont'd.	°	°	°	*Ins.*	*Ins.*
Tiffin	94	53	77.0	4.69	
Upper Sandusky	101	50	79.0	2.32	
Urbana	96	56	77.7	4.51	
Vanwert	100	50	78.2	1.63	
Vermillion	98	55	76.8	2.39	
Vickery	99	49	77.4	1.71	
Walnut	......	......	......	2.79	
Warren	98	52	76.6	2.93	
Warsaw	102	48	77.4	2.34	
Wauseon	101	51	78.4	2.36	
Waverly	105	53	81.0	4.66	
Waynesville	105	50	79.2	2.22	
Wellington	98	51	77.8	3.50	
Westerville [d]	103	50	76.4	1.01	
Willoughby	......	......	......	4.50	
Wooster	95	50	76.0	3.32	
Zanesville	......	......	......	2.72	
Oklahoma.					
Arapaho	111	59	85.8	2.10	
Beaver	108	63	85.0	1.36	
Blackburn	109	54	86.2	0.62	
Burnett	106	54	84.6	0.26	
Chandler	105	62	85.8	4.60	
Clifton	108	55	85.6	1.68	
Enid	108	64	87.9	3.70	
Fort Reno	106	60	85.9	0.36	
Fort Sill	104	62	84.9	1.55	
Hennessey	108	63	87.5	1.82	
Jefferson	111	57	86.5	4.90	
Jenkins	103	60	83.7	1.86	
Kenton	101	42	76.4	0.49	
Kingfisher	107	60	85.9	2.26	
Mangum	103	70	86.4	0.83	
Newkirk	110	69	88.0	4.24	
Norman	106	57	84.2	0.31	
Pawhuska	107	57	86.2	1.50	
Perry	107	57	86.2	1.79	
Prudence	......	......	......	2.42	
Sac and Fox Agency	109	66	85.6	3.25	
Shawnee	105	61	86.2	0.93	
Stillwater	105	60	86.2	1.48	
Taloga	111[d]	60[d]	89.4[d]	0.31	
Vittum	105	66	87.0	1.41	
Waukomis	108	61	88.1	3.03	
Weatherford	108	65	87.1	0.07	
Woodward	106	64	86.2	1.42	
Oregon.					
Albany *a* *[1]	86	51	65.7	0.00	
Albany *b*	......	......	......	0.03	
Alpha	85	37	59.8	0.55	
Arlington	98	49	71.0	T.	
Ashland *b*	94	36	66.6	0.00	
Aurora *[1]	85	51	66.8	0.00	
Aurora (near)	84	40	61.0	0.09	
Bay City	68	38	55.0	2.68	
Bend	91	29	60.3	......	
Beulah	107	28	70.6	0.00	
Blalock	101	52	74.6	T.	
Brownsville *[1]	92	50	66.1	0.00	
Bullrun	81	44	60.8	0.53	
Burns	97	29	68.1	0.00	
Burns (near)	96	32	64.6	0.00	
Cascade Locks	90	50	68.0	0.13	
Comstock *[1]	91	49	65.2	0.00	
Coquille	......	......	......	0.02	
Corvallis	86	40	62.1	T.	
Dayville	96	40	67.8	0.17	
Ella	......	......	......	T.	
Eugene	86	41	62.1	T.	
Fairview	79	39	59.2	0.24	
Falls City	88	38	60.0	0.06	
Gardiner	73	40	58.1	0.10	
Glenora	87	35	58.8	0.87	
Government Camp	82	35	53.6	0.70	
Grants Pass	96	35	66.4	0.16	
Hare	75	43	55.8	0.28	
Harris	90	40	63.4	00.3	
Hood River (near)	94	43	64.2	T.	
Huntington	106	42	81.4	0.00	
Jacksonville	95	39	67.7	0.02	
Joseph	91	31	61.8	0.02	
Junction City *[5]	90	46	66.9	......	
Kerby	98	35	66.0	0.00	
Klamath Falls	98	31	68.1	......	
Lafayette *[1]	90	52	62.0	0.00	
Lagrande	96	39	68.8	0.27	
Lakeview	96	30	68.8	0.00	
Lonerock	92	35	62.4	0.21	
McMinnville	89	37	61.5	T.	
Merlin *[1]	96	44	70.0	0.05	
Monroe	86	41	61.7	0.12	
Mount Angel	87	44	63.2	0.05	
Nehalem	......	......	......	2.52	
Newberg	85[g]	36[g]	61.2[g]	0.12	
Newbridge	97	38	69.5	T.	
Newport	67	42	55.6	0.41	
Oregon—Cont'd.	°	°	°	*Ins.*	*Ins.*
Pendleton	103	40	70.4	0.44	
Placer	......	......	......	0.42	
Prineville	98	29	65.0	T.	
Riddles *[1]	94	48	66.6	0.00	
Riverside	108	30	73.5[d]	T.	
Shaniko	88	88	62.7	T.	
Sheridan *[1]	80	53	63.8	0.00	
Silverton *[1]	88	56	66.5	0.25	
Siskiyou *[1]	95	41	64.7	0.10	
Sparta	97	35	70.2	0.50	
Springfield *[1]	80	51	64.8	0.00	
Stafford	87	41	62.5	0.19	
The Dalles	94	44	68.4	T.	
Toledo	79	40	57.7	0.25	
Umatilla	......	......	......	0.02	
Vale	105	33	70.4	T.	
Westfork *[1]	98	50	69.8	0.00	
Weston	96	39	66.8	0.27	
Williams	92	35	63.5	T.	
Pennsylvania.					
Aleppo	97	51	77.1	3.46	
Altoona	98	52	74.6	5.83	
Athens	99	50	74.9	3.32	
Beaver Dam	......	......	......	2.53	
Bellefonte	97	56	76.8	3.62	
Bethlehem	......	......	......	3.66	
Brookville	......	......	......	2.73	
Browers Lock	......	......	......	5.14	
Butler	95	53	75.6	3.86	
Cassandra	94	53	73.1	3.71	
Centerhall	99	53	75.4	5.45	
Coatesville	103	58	79.2	5.51	
Confluence	99	55	76.7	3.55	
Davis Island Dam	......	......	......	2.46	
Derry Station	101	54	78.7	4.48	
Doylestown	......	......	......	7.20	
Drifton	93	54	74.0	3.11	
Driftwood	......	......	......	3.68	
Duncannon	......	......	......	2.66	
Dushore	98	47	73.4	5.34	
East Bloomsburg	......	......	......	1.64	
East Mauch Chunk	102	56	77.4	2.61	
Easton	99	57	78.4	3.11	
Ellwood Junction	......	......	......	1.82	
Emporium	96	45	74.4	4.07	
Ephrata	102	57	78.5	5.61	
Everett	98	54	76.0	5.22	
Forks of Neshaminy *[1]	92	64	76.8	7.34	
Franklin	95	48	74.1	2.87	
Freeport	......	......	......	2.92	
Girardville	......	......	......	3.21	
Greensboro	......	......	......	2.59	
Hamburg	......	......	......	4.88	
Hamlinton	95	49	73.9	3.94	
Herrs Island Dam	......	......	......	2.82	
Huntingdon *a*	102	53	76.4	6.69	
Huntingdon *b*	......	......	......	5.20	
Irwin	......	......	......	3.36	
Johnstown	98	57	78.3	2.00	
Karthaus	......	......	......	1.23	
Keating	......	......	......	3.90	
Kennett Square	101	60	78.4	4.91	
Lansdale	......	......	......	6.68	
Lawrenceville	97	......	......	2.99	
Lebanon	101	58	78.2	3.61	
Leroy	94	53	73.4	3.22	
Lewisburg	100[e]	56[e]	77.4[e]	5.02	
Lockhaven *a*	102	58	78.6	2.33	
Lockhaven *b*	......	......	......	3.21	
Lock No. 4	......	......	......	4.90	
Lycippus	95	55	76.2	3.91	
Mifflin	......	......	......	4.25	
Oil City	......	......	......	3.42	
Ottsville	......	......	......	3.49	
Parker	......	......	......	2.39	
Philadelphia	103	62	79.4	5.00	
Point Pleasant	......	......	......	3.00	
Pottstown	101	61	80.4	3.81	
Pottsville	......	......	......	2.49	
Quakertown	101	55	78.4	2.22	
Reading [2]	......	......	78.0	3.56	
Renovo *a*	......	......	......	3.31	
Renovo *b*	97	56	76.6	2.75	
Saegerstown	95	50	73.6	2.25	
St. Marys	94	50	73.4	3.85	
Seisholtzville	......	......	......	5.09	
Selinsgrove	100	58	77.5	5.59	
Shawmont	......	......	......	3.61	
Shinglehouse	94[f]	46	72.6[d]	2.67	
Smethport	95	50	72.0	4.70	
Somerset	98	40	73.7	4.60	
South Eaton	96	55	75.4	5.32	
State College	94	56	75.2	3.60	
Sunbury	......	......	......	1.60	
Swarthmore	99	64	78.2	4.00	
Towanda	95	53	74.8	3.51	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Pennsylvania—Cont'd.	°	°	°	*Ins.*	*Ins.*
Troutrun	......	......	......	5.66	
Uniontown	95	50	77.8	2.38	
Warren	93	50	73.0	6.00	
Wellsboro	96	54	74.2	2.27	
Westchester	100	60	78.4	6.65	
West Newton	......	......	......	4.02	
Wilkesbarre	101	54	78.2	2.74	
Williamsport	97	63	79.6	3.29	
York	107	60	80.0	3.33	
Rhode Island.					
Bristol	87	57	72.0	3.89	
Kingston	93	51	72.0	4.05	
Pawtucket	97	57	81.7	2.83	
Providence *a*	99	58	77.9	2.93	
South Carolina.					
Allendale	99	70	83.3	3.87	
Anderson	99	69	82.1	4.20	
Batesburg	102	68	82.6	0.82	
Beaufort	96	72	81.5	4.48	
Blackville	101	69	82.6	2.97	
Calhoun Falls	......	......	......	2.09	
Camden	......	......	......	3.69	
Cheraw *a*	96	67	80.4	6.20	
Cheraw *b*	......	......	......	5.66	
Clemson College	99	65	80.6	2.56	
Conway	......	......	......	7.87	
Darlington	......	......	......	6.69	
Edisto	......	......	......	2.89	
Effingham	......	......	......	4.10	
Florence	98	68	82.6	4.37	
Gaffney	......	......	......	2.47	
Georgetown	97	70	82.2	13.25	
Gillisonville	101	66	81.8	4.64	
Greenville	93	65	77.9	4.51	
Greenwood	101	65	81.7	2.58	
Kingstree *a*	94	66	80.3	2.33	
Kingstree *b*	......	......	......	2.39	
Liberty	95	66	79.1	6.89	
Little Mountain	100	67	82.8	2.13	
Longshore	102	66	82.0	5.51	
Pinopolis *[1]	94	62	79.4	3.93	
St. Georges	96	69	81.2	5.22	
St. Matthews	98	70	81.7	3.05	
St. Stephens	......	......	......	3.70	
Santuck	100	64	81.4	2.66	
Smiths Mills	......	......	......	6.65	
Society Hill	96	68	81.4	9.61	
Spartanburg	98	66	81.6	3.49	
Statesburg	96	68	81.3	4.27	
Summerville	93	67	79.4	5.15	
Temperance	100	66	81.2	10.40	
Trenton	96	72	82.3	3.33	
Trial	95	65	79.0	1.13	
Walhalla	95	62	77.9	2.84	
Winnsboro	100	67	82.8	0.65	
Winthrop College	96	67	81.0	4.08	
Yemassee	99	69	82.6	4.64	
Yorkville	99	69	82.7	3.06	
South Dakota.					
Aberdeen	107	48	77.3	2.42	
Academy	106	56	81.2	1.92	
Alexandria	106	52	79.4	2.32	
Armour	104	50	79.4	2.16	
Ashcroft	109	44	75.8	0.96	
Bowdle	109	45	76.2	3.00	
Brookings	103	48	76.2	1.66	
Canton	106	50	81.2	0.48	
Centerville	......	......	......	1.45	
Chamberlain	107	54	81.6	1.35	
Clark	105	48	75.2	2.76	
Desmet	104	50	76.2	0.88	
Doland	106	44	77.3	2.31	
Elkpoint	103	57	81.2	1.14	
Farmingdale	......	......	......	2.25	
Faulkton	105	50	77.0	1.89	
Flandreau	102	49	76.6	1.04	
Forestburg	106	50	80.4	1.82	
Fort Meade	105	48	75.6	2.83	
Gannvalley	107	50	81.2	1.18	
Gary	106	54	78.4	1.80	
Grand River School	108	47	77.7	1.93	
Greenwood	......	......	......	0.56	
Hartman	101	52	78.2	1.57	
Highmore	......	......	......	2.68	
Hitchcock	......	......	......	2.24	
Howard	100	......	......	2.31	
Ipswich	115	49	77.8	3.10	
Kimball	102	54	78.8	0.66	
Leola	105	49	73.6	2.88	
Leslie	114	46	83.0	1.90	
Marion	106	54	80.2	0.99	
Mellette	106[c]	49	77.6[c]	1.78	
Menno	108	50	81.2	1.18	
Millbank	107	50	77.2	1.59	
Mitchell	104	48	79.4	2.25	
Mound City	108	47	76.8	3.69	
South Dakota—Cont'd.	°	°	°	*Ins.*	*Ins.*
Oelrichs	108	46	78.4	0.70	
Pine Ridge	105	44	79.5	1.54	
Plankinton	105	51	79.0	0.88	
Redfield	105	47	76.7	1.50	
Rochford	98	34	68.4	2.23	
Rosebud	108	44	79.4	1.84	
St. Lawrence	110	49	80.5	1.18	
Silver City	......	......	......	2.58	
Sioux Falls	102	55	79.9	1.40	
Sisseton Agency	98[d]	54[d]	72.8[d]	1.76	
Spearfish	101	51	74.5	2.94	
Tyndall	105	53	83.2	0.66	
Vermillion	108	56	83.9	1.57	
Waubay	100	49	73.3	2.27	
Wentworth	102	52	77.3	2.60	
Wessington Springs	105	47	74.6	1.60	
Wolsey	......	......	......	0.56	
Tennessee.					
Andersonville	100	53	79.3	0.20	
Arlington	107	54	83.7	0.32	
Ashwood	106	54	83.4	2.00	
Benton	99	55	80.0	2.15	
Bluff City	......	......	......	4.41	
Bolivar	106	55	83.6	1.18	
Bristol	95	56	76.4	7.14	
Brownsville	107	57	83.4	1.17	
Byrdstown	98	53	78.8	3.21	
Carthage	103	54	81.6	2.29	
Clarksville	104	57	83.8	0.25	
Clinton	......	......	......	0.23	
Covington	105	57	83.0	1.47	
Decatur	103	56	81.2	0.67	
Dickson	102	......	......	1.89	
Dover	......	......	......	0.84	
Dyersburg	107[f]	57	85.1[c]	1.15	
Elizabethton	98	54	77.4	1.66	
Elk Valley	99	52	77.5	2.93	
Erasmus	96	45	74.2	4.31	
Florence	100	59	81.4	1.21	
Franklin	100	54	81.4	1.21	
Grace *[1]	104	60	83.6	2.30	
Greeneville	97	55	76.6	3.60	
Harriman	99	54	79.4	3.19	
Hohenwald	104	48	81.0	1.50	
Iron City	102	52	80.5	1.98	
Johnsonville	107	50	82.4	2.62	
Jonesboro *[1]	92	65	76.7	2.66	
Kingston	......	......	......	1.19	
Lafayette *[5]	101	57	81.8	1.00	
Lewisburg	104	53	82.4	3.58	
Liberty	104	51	81.7	2.13	
Lynnville	102	56	80.6	2.11	
Maryville	104	62	81.6	2.63	
Milan	107	56	85.4	0.06	
Newport	97	57	79.3	2.79	
Nunnelly	104	49	81.6	1.12	
Oakhill	98	50	78.1	1.59	
Palmetto	101	57	82.5	3.30	
Peryear	104	56	84.4	0.50	
Pope	106	50	82.8	1.38	
Rogersville	94	58	77.0	2.72	
Rugby	99	50	77.2	3.48	
Savannah	104	59	83.4	2.72	
Sewanee	94	55	77.6	1.39	
Silverlake	88	52	71.6	4.45	
Springdale	100	52	77.9	2.75	
Springfield	107	50	83.0	T.	
Tazewell	......	......	......	2.08	
Tellico Plains	100	57	79.8	2.93	
Tracy City	103	51	77.6	3.31	
Tullahoma	100	53	78.6	2.50	
Union City	107	58	83.7	2.25	
Waynesboro	102	57	80.8	2.62	
Wildersville	100	55	81.4	1.63	
Yukon	101	59	81.2	3.35	
Texas.					
Alvin	......	......	......	6.18	
Anna [d]	108	65	86.2	3.29	
Anson	......	......	......	1.00	
Arthur	......	......	......	3.36	
Austin *a*	102	65	82.5	2.50	
Austin *b* *[5]	98	70	83.0	......	
Ballinger	103	70	87.4	0.83	
Bastrop	98	......	......	0.70	
Beaumont	104	61	81.0	3.41	
Beeville	105	67	82.4	6.20	
Big Spring	......	......	......	4.73	
Blanco	102	[illegible]	82.9	1.58	
Boerne *[1]	100	70	82.8	6.04	
Booth	......	......	......	6.13	
Bowie	107	65	87.6	0.35	
Brazoria	96	72[c]	83.0[d]	9.99	
Brenham	100	65	84.6	1.61	
Brighton	94[c]	72[c]	83.6[c]	0.95	
Burnet [f]	102	59	79.4	0.71	
Camp Eagle Pass	105	70	87.1	0.00	
Texas—Cont'd	°	°	°	*Ins.*	*Ins.*
Coleman	100	65	82.6	0.68	
College Station	106	62	82.0	1.54	
Columbia	97	70	82.2	6.00	
Comanche	103	59	83.0	0.60	
Corsicana	105	70	86.8	0.51	
Cotulla	106	68	87.4	0.82	
Cuero	100	71	86.8	6.06	
Dallas	106	68	86.4	0.47	
Danevang	100	70	83.6	5.58	
Dublin	104	67	85.0	1.18	
Duval	99	73	84.0	2.61	
Estelle	107	67	86.6	1.94	
Fort Clark	105	72	86.1	1.40	
Fort Ringgold	102	72	88.2	1.90	
Fort Stockton	......	......	......	1.50	
Fredericksburg	......	......	......	3.31	
Gainesville	106	66	85.6	4.36	
Grapevine	107[d]	60[d]	86.7[d]	1.84	
Greenville	108	65	87.0	1.69	
Hale Center	102	61	77.4	3.23	
Hallettsville	101	72	85.0	3.69	
Haskell	110	64	88.6	2.18	
Hearne	102	74	87.3	0.55	
Henrietta	106	64	87.4	2.01	
Hewitt	......	......	......	0.90	
Hondo	......	......	......	7.05	
Houston	100	72	84.3	4.39	
Huntsville	98	69	84.4	2.35	
Ira	105	63	82.8	4.73	
Jacksonville	103	60	82.5	1.86	
Jasper	101	71	83.4	5.62	
Junction	......	......	......	3.90	
Kent	......	......	......	2.60	
Kerrville	99	61	78.4	3.74	
Kopperl	......	......	......	0.95	
Lampasas	104	63	84.6	1.30	
Laureles Ranch	......	......	......	0.77	
Llano *[5]	104	74	85.9	1.80	
Longview	106	67	86.2	3.55	
Luling	100	72	84.9	2.11	
Menardville	102	59	85.4	5.01	
Mount Blanco	103	57	80.4	1.05	
Nacogdoches	101	67	82.6	4.62	
New Braunfels	100	70	83.4	3.16	
Paris *a*	108	67	85.8	5.35	
Port Lavaca	97	74	84.2	3.40	
Rhineland	108	62	87.1	0.25	
Rockisland	103	71	84.0	2.80	
Rockport	97	69	82.0	0.75	
Runge	105	70	84.7	3.81	
Sanderson	102	70	85.5	1.10	
San Marcos	102	69	85.2	5.40	
San Saba	107	62	85.8	0.95	
Santa Gertrudes Ranch	......	......	......	1.65	
Sherman	101	69	85.8	2.40	
Sugarland	101	70	83.4	1.96	
Sulphur Springs	105	64	84.8	3.89	
Temple *b*	105	72	86.5	0.97	
Trinity	105	67	83.7	1.12	
Tyler	105	71	87.6	0.48	
Valentine	104	60	80.9	......	
Victoria	......	......	......	3.25	
Waco	105	72	88.2	T.	
Waxahachie	106	68	81.8	0.85	
Weatherford	106	63	86.7	0.77	
Wichita Falls	......	......	......	1.80	
Utah.					
Alpine	......	......	......	0.29	
Aneth	104	50	81.6	1.05	
Blackrock	99	39	74.0	0.15	
Bluecreek *[1]	100	58	80.7	0.10	
Castledale	97	36	69.3	0.82	
Cisco	106	56	82.2	T.	
Corinne	108	45	80.0	0.00	
Coyoto	95	33	66.9	0.72	
Deseret	103	39	76.0	0.08	
Emery	97	40	72.5	T.	
Farmington	100	50	78.2	T.	
Fillmore	112	41	81.3	0.41	
Fish Springs	113	48	83.3	0.25	
Fort Duchesne	102	41	74.0	0.14	
Frisco	103	43	73.6	1.76	
Giles	105	42	80.4	0.04	
Government Creek	100	44	77.2	0.64	
Green River	108	49	81.0	T.	
Grover	98	50	73.4	0.44	
Heber	98	30	69.0	0.40	
Henefer	98	29	67.1	0.27	
Hite	115	64	89.6	T.	
Huntsville	......	......	......	T.	
Kelton *[1]	114	65	78.1	0.00	
Lasal	94	51	73.5	0.81	
Levan	101	41	74.6	0.25	
Loa	95[j]	29	64.4[f]	0.67	
Logan	100	47	76.7	0.07	
Manti	101	41	72.5	0.22	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Utah—Cont'd.	°	°	°	*Ins.*	*Ins.*
Marysvale	99	41	70.8	0.82	
Meadowville	95	34	69.0	1.70	
Millville	......	......	......	0.03	
Minersville	101[e]	46[e]	76.7[e]	0.86	
Moab	102	48	76.6	0.39	
Mount Pleasant	100	45	74.9	0.19	
Ogden *a* *[1]	104	63	82.2	T.	
Park City	96	38	71.0	0.90	
Parowan	99	45	74.4	0.04	
Pinto	96	38	70.3	0.80	
Promontory	......	......	......	T.	
Provo	104	39	75.8	T.	
Richfield	101	48	75.2	0.14	
St. George	110	52	82.8	0.48	
Scipio	106	38	76.9	1.12	
Snowville	102	32	72.6	0.20	
Soldier Summit	......	27	......	1.00	
Terrace	......	......	......	T.	
Thistle	106	33	74.6	0.11	
Tooele	100	51	78.8	0.35	
Tropic	95	32	67.5	1.20	
Vernal	100	42	76.0	0.21	
Wellington	102	41	68.7	0.83	
Vermont.					
Burlington	93	55	73.8	2.29	
Chelsea	91	45	68.0	3.95	
Cornwall	96	51	72.2	4.61	
Enosburg Falls	96	40	69.2	3.84	
Hartland	93	44	69.3	3.39	
Jacksonville	95	42	70.5	3.81	
Manchester	90	45	70.3	6.06	
Norwich	97	43	69.8	4.81	
St. Johnsbury	93	44	69.5	4.96	
Vernon *[6]	98	59	74.6	5.24	
Wells	95	52	71.8	3.66	
Woodstock	96	40	70.3	3.50	
Virginia.					
Alexandria	104	65	80.8	9.82	
Ashland	103	65	81.8	6.82	
Barboursville	98	62	79.7	5.89	
Bedford	99	60	80.8	5.07	
Bigstone Gap	95	55	76.5	2.84	
Birdsnest[2]	......	......	77.9	3.05	
Blacksburg	92	53	74.0	4.51	
Bon Air	99	66	80.2	8.86	
Buckingham	103	58	79.6	2.49	
Burkes Garden	88	47	70.4	3.76	
Callaville	96	68	80.3	2.44	
Charlottesville	97	62	79.0	7.23	
Clarksville	......	......	......	4.32	
Columbia	103	62	81.0	5.60	
Dale Enterprise	95	53	74.4	4.83	
Danville	......	......	......	6.28	
Farmville	102	63	82.2	4.20	
Fontella	99	61	80.0	6.90	
Fredericksburg	100	66	81.2	5.33	
Grahams Forge	......	......	......	4.30	
Hampton	98	69	80.6	5.60	
Hot Springs	90	50	72.4	3.79	
Lincoln	98	62	79.4	5.12	
Manassas	99	63	80.0	5.80	
Marion	96	52	75.2	3.64	
Newport News	103	70	82.8	6.04	
Petersburg	100	65	81.0	3.64	
Quantico	104	52	76.1	......	
Radford	......	......	......	4.93	
Salem	......	......	......	6.02	
Speers Ferry	......	......	......	2.88	
Spottsville	101	66	81.4	4.63	
Stanardsville	99	60	78.8	5.51	
Staunton	96	57	78.2	5.39	
Stephens City	106	58	80.2	3.82	
Warsaw	99	65	77.9	7.26	
Westpoint	98	62	78.5	7.70	
Williamsburg	96	66	79.8	5.72	
Woodstock	98	61	79.0	3.50	
Wytheville	95	53	75.4	3.67	
Washington.					
Aberdeen	74	37	55.7	1.45	
Anacortes	......	......	......	0.36	
Ashford	......	......	......	0.70	
Bremerton	84	40	61.2	0.28	
Brinnon	77	43	60.7	0.13	
Buchanan's Farm	......	......	......	0.43	
Cedonia	88	40	62.7	1.47	
Centerville	93	35	64.6	T.	
Cheney	......	......	......	0.05	
Clearwater	70	40	56.6	2.12	
Cle Elum	90	35	61.3	T.	
Colfax	99	38	66.3	0.89	
Colville	95	36	63.1	0.69	
Conconully	90	39	64.2	0.24	
Connell	......	......	......	0.09	
Coulee City	98	47	70.7	0.04	
Coupeville	75	43	59.6	0.42	
Crescent	95	38	63.9	0.83	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Washington—Cont'd.	°	°	°	*Ins.*	*Ins.*
Dayton	104	32	68.6	0.24	
East Sound	79	31	58.0	0.21	
Ellensburg	90	40	64.0	0.00	
Ellensburg (near)	94:	42	66.6	T.	
Grandmound	81	41	61.2	0.42	
Granite Falls	......	......	......	1.12	
Hooper	102	43	71.0	0.33	
Ilwaco	74	44	58.9	2.48	
Lacenter	89	42	62.3	0.20	
Lakeside	92	50	69.9	0.00	
Lind	100	35	73.2	0.60	
Mayfield	86	38	61.6	0.68	
Monte Cristo	84	35	58.0	1.97	
Mottinger Ranch	103	50	73.0	0.05	
Mount Pleasant	84	43	61.8	0.31	
Moxee Valley	98	39	67.9	0.08	
Northport	99	36	68.2	2.15	
Olga	72	41	57.6	0.39	
Olympia	84	37	60.5	0.49	
Pasco	106	55	79.4	0.00	
Pinehill	95	42	67.0	T.	
Pomeroy	......	......	......	0.82	
Port Townsend	74	42	57.6	0.16	
Pullman	95	39	66.1	0.67	
Republic	96[j]	37[f]	63.3[h]	1.51[f]	
Ritzville	......	......	......	0.25	
Rosalia	94	37	62.9	0.91	
Sedro	80	31	58.7	0.91	
Silvana	78	38	59.3	0.79	
Snohomish	78	36	58.9	0.42	
Snoqualmie	87	30	57.5	1.15	
Southbend	81	36	57.4	1.17	
Sprague	......	......	......	0.50	
Stampede	......	......	......	0.40	
Sunnyside	97	44	68.8	0.10	
Twin	68	40	53.6	0.60	
Union	83	39	61.6	0.41	
Vancouver	82	42	61.4	0.18	
Vashon	78	42	60.0	0.33	
Waterville	94	39	65.6	0.25	
Wenatchee (near)	91	43	66.4	0.02	
Whatcom	73	37	58.7	0.34	
Wilbur	93	34	62.0	0.55	
West Virginia.					
Beckley	91	53	73.4	1.34	
Belleville	97	58[c]	79.2[c]		
Beverly	94	55	75.5	4.77	
Bluefield	93	51	73.6	3.28	
Byrne	99	54	78.5	4.00	
Central	98	53	77.2	3.87	
Charleston	......	......	......	2.08	
Clay	101	50	80.2	3.80	
Creston	103	56	81.6	1.05	
Dayton	97	53	77.9	3.33	
Echo	100	53	73.4		
Elkhorn	94	52	75.9	3.48	
Fairmont	......	......	......	1.91	
Glenville	100	56	78.7	2.93	
Grafton	96	52	76.1	3.32	
Green Sulphur	92	53	76.1	3.53	
Harpers Ferry	......	......	......	4.85	
Hinton *a*	......	......	......	2.85	
Hinton *b*	97[d]	56[d]	76.6[d]	2.85	
Huntington	100	57	79.8	3.59	
Josiah	101	56	79.6	6.21	
Lewisburg	94	51	75.0	3.78	
Magnolia	104	52	79.0	4.29	
Mannington	101	53	78.7	4.35	
Marlinton	92	51	73.4	3.59	
Martinsburg	99	60	78.0	5.60	
Morgantown	98	53	77.6	1.86	
Moscow	95	57	77.2	3.25	
New Martinsville	104	57	80.6	4.96	
Nuttallburg	96	53	76.2	3.70	
Oceana	99	54	77.7	1.54	
Oldfields	97	56	78.2	2.82	
Parsons	95	58	75.8	3.50	
Philippi *a*	96	47	72.6	1.76	
Point Pleasant	102	58	81.0	0.71	
Powellton	97	54	77.8	4.20	
Princeton	89	54	73.7	5.00	
Romney	101	54	77.6	2.45	
Rowlesburg	......	......	......	3.13	
Southside	99	59	80.3	1.38	
Spencer	99	54	78.1	1.21	
Uppertract	97	52	76.0	3.48	
Wellsburg	94	53	75.8	3.53	
Weston *a*	......	......	......	2.00	
Weston *b*	98	56	78.8		
Wheeling *a*	......	......	......	3.19	
Wheeling *b*	103	54	84.6	2.36	
Williamson	98	56	79.0	4.15	
Winfield	95	57	77.8	1.72	
Wisconsin.					
Amherst	99	46	74.4	4.85	
Antigo	98	40	72.4	3.30	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Wisconsin—Cont'd.	°	°	°	*Ins.*	*Ins.*
Appleton	94	50	74.2	5.27	
Ashland	......	......	......	6.44	
Barron	102	42	74.1	5.10	
Bayfield	104	48	69.8	1.00	
Beloit	105	48	80.2	2.13	
Brodhead	111	44	81.3	3.83	
Butternut	95	41	68.4	5.41	
Chilton	100	42	74.2	4.74	
Citypoint	100	33	76.1	4.30	
Darlington	104	42	76.8	4.40	
Dodgeville	107	44	78.6	4.22	
Easton	106	47	77.3	3.71	
Eau Claire	103	50	76.8	4.01	
Florence	96	37	68.7	9.17	
Grand River Locks	......	......	......	5.45	
Grantsburg	103	43	73.6	3.49	
Hartland	103	43	77.7	3.48	
Harvey	107	47	79.4	1.37	
Hayward	102	39	72.0	4.00	
Hillsboro	106	44	76.6	3.58	
Koepenick	95	34	70.0	7.80	
Ladysmith	98	46	73.5	1.21	
Lancaster	107	42	79.8	1.66	
Madison	104	53	79.6	1.54	
Manitowoc	97	45	70.2	4.22	
Meadow Valley	104	46	75.6	7.40	
Medford	102	40	73.0	4.75	
Menasha	......	......	......	5.09	
Neillsville	100	44	76.1	5.27	
New London	100	47	74.2	6.22	
North Crandon	95[j]	35[j]	67.4[j]	9.26	
Oconto	99	56	75.5	3.09	
Osceola	105	44	74.0	3.79	
Oshkosh	97	51	76.6	5.55	
Pepin	103	60	82.4	2.11	
Pine River	99	49	74.4	4.17	
Portage	106	48	79.6	2.44	
Port Washington	102	42	71.0	4.16	
Prairie du Chien *a*	110	50	82.9	2.68	
Prairie du Chien *b*	......	......	......	2.45	
Prentice	95	40	71.7	6.14	
Racine	107	48	76.0	0.86	
Shawano	98	43	73.0	4.52	
Sheboygan	101	48	71.7	3.39	
Stevens Point	101	45	74.8	4.01	
Viroqua	103	46	76.2	7.22	
Watertown	104	45	77.4	5.02	
Waukesha	102	54	78.0	2.01	
Waupaca	100	46	75.0	5.30	
Wausaukee	100	39	71.7	6.23	
Westbend	101	54	76.8	3.88	
Wyoming.					
Alcova	107	44	77.8	1.27	
Basin	......	......	......	0.05	
Bedford [k]	97	39	68.6	0.14	
Bitter Creek	110	36	72.1	3.00	
Buffalo	103	45	72.0	0.55	
Burlington [l]	105	46	73.8	0.85	
Casper	103	45	76.0	2.87	
Centennial	87	34	65.6	1.00	
Chugwater	100	39	70.8	0.92	
Evanston	92	31	64.6	0.82	
Fort Laramie	106	43	76.4	1.62	
Fort Washakie	97	40	70.8	T.	
Fort Yellowstone	96	30	67.4	0.80	
Fourbear	92	32	66.0	0.38	
Griggs	103	44	72.8	1.09	
Hyattville	104	41	75.1	0.00	
Iron Mountain	95	40	70.4	2.41	
Laramie	92	44	67.8	0.32	
Leo	94	33	69.2	1.03	
Lusk	97	45	73.2	0.05	
Moore	97	31	65.2	1.14	
Myersville	97	28	67.6	T.	
Parkman	107	37	72.2	0.42	
Pinebluff	99	44	72.9	1.00	
Rawlins	98	33	70.0	0.47	
Saratoga	97	34	71.2	0.19	
Sheridan	105	39	72.5	0.68	
Springhill	100	47	75.4	1.05	
Thermopolis	105	45	76.4	0.23	
Wheatland	105	50	77.4	0.77	
Cuba.					
Aguacate	95	71	84.4	9.65	
Alvarez	......	......	......	4.74	
Australia	94[e]	68	81.2[e]	8.66	
Banaguises	92	63	78.9	13.45	
Batabano	99	69	83.2	3.44	
Camajuani	92	65	77.2	11.65	
Ciego de Avila	......	......	......	11.05	
Cruces	......	......	......	7.63	
Gibara	95	69	81.2	5.00	
Guabairo	......	......	......	11.25	
Guanajay	90	67	78.0	8.10	
Guantanamo	95	68	81.8	4.23	
Guines	92	69	81.8	12.93	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Cuba—Cont'd.	°	°	°	*Ins.*	*Ins.*
Holguin	95	68	81.0	2.94	
Isabel, Guantanamo	......	......	......	6.62	
Limonar	......	......	......	4.51	
Los Canos	96	60	80.4	2.76	
Magdalena	......	......	......	8.89	
Manzanillo	96	74	*83.6	8.84	
Moron Trocha	96	68	81.9	6.98	
Nuevitas	100	69	85.6	2.50	
Pinar del Rio	93	70	81.2	10.22	
Romelle, Guantanamo	......	......	......	5.83	
San Ceyetano	93	68	80.6	7.30	
Sancti Spiritus	88	71	78.2	9.76	
Santa Cruz del Sur	93	70	81.1	9.58	
Soledad	92	67	79.4	8.34	
Soledad, Guantanamo	93	65	79.8	6.35	
Union de Reyes	92	73	82.1	5.18	
Yaguajay	91	69	80.4	13.97	
Yateras	......	......	......	6.83	
Porto Rico.					
Adjuntas	85	60	75.2	11.59	
Aguirre	90	70	81.0	9.17	
Arecibo	91	69	78.5	5.62	
Barros	......	......	......	13.18	
Bayamon	95	68	80.9	9.70	
Caguas	89	67	78.8	23.35	
Canovanas	90	72	80.4	17.43	
Cayey	94	62	79.2	16.57	
Cidra	93	60	77.0	12.51	
Coamo	96	69	81.4	8.81	
Comerio	90	66	78.5	11.25	
Corozal	93	66	78.8	15.41	
Fajardo	91	71	81.1	16.01	
Guayama	......	......	......	11.08	
Hacienda Coloso	95	66	79.2	8.60	
Hacienda Perla	90	70	79.4	33.57	
Humacao	88	64	76.2	14.76	
Isabela	92	70	80.4	4.61	
La Isolina	88	67	76.6	9.14	
Las Marias	93	67	79.0	6.99	
Manati	95	68	80.5	8.40	
Mayaguez	93	67	80.0	17.06	
Morovis	92	67	78.4	13.19	
Ponce	92	58	75.5	6.39	
San Lorenzo	93	64	78.4	11.63	
San Salvador	90	65	76.6	6.58	
Santa Isabel	92	71	80.0	6.79	
Porto Rico—Cont'd.	°	°	°	*Ins.*	*Ins.*
Utuado	......	66	......	6.48	
Yauco	91	68	79.8	9.72	
Mexico.					
Ciudad P. Diaz	108	74	88.2	0.42	
Coatzacoalcos	92	68	80.0	24.20	
Leon de Aldamas	88	56	70.8	3.19	
Puebla	78	54	65.8	6.52	
Tampico	92	73	81.8	8.64	
Vera Cruz	95	70	81.6	16.18	
New Brunswick.					
St. John	82	48	63.8	1.48	
Isthmus of Panama.					
Alhajuela	91	70	77.4	7.95	
La Boca	88	75	81.5	9.75	

Late reports for June, 1901.

Stations.	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Alaska.	°	°	°	*Ins.*	*Ins.*
Fort Liscum	67	32	49.6	1.13	
Fort Yukon	85	26	58.6	0 41	
Holy Cross Mission	70	29	51.9	0.85	
Juneau	69	39	53 2	2.13	
Kenai	69	26	50.8	0.06	
St. Michael	61	23	40.8	......	
Wood Island	78	37	51.2	4.50	
Arkansas.					
Dutton	92	46	74.2	3.18	
California.					
Jackson	97	38	66.4	0.08	
Kernville	......	......	......	0.00	
Idaho.					
Garnet	101	35	68.4		
Illinois.					
Danville	96	39	78.5	2.00	
Kentucky.					
Carrollton	98	55	76.4	4.54	
Louisiana.					
Sugartown	99	......	......	4.37	
Michigan.					
Ludington	95	......	......	0.56	
Missouri.					
Conception	......	......	......	2.44	
New York.					
Westfield *c*	86	40	66.2	......	
Oregon.	°	°	°	*Ins.*	*Ins.*
Bullrun	84	43	55.6	5.17	
Washington.					
Mayfield	92[d]	37	53.0	4.97	
Porto Rico.					
Hacienda Coloso	95	66	79.6	11.50	

EXPLANATION OF SIGNS.

* Extremes of temperature from observed readings of dry thermometer.

A numeral following the name of a station indicates the hours of observation from which the mean temperature was obtained, thus:

[1] Mean of 7 a. m. + 2 p. m. + 9 p. m. + 9 p. m. ÷ 4.
[2] Mean of 8 a. m. + 8 p. m. ÷ 2.
[3] Mean of 7 a. m. + 7 p. m. ÷ 2.
[4] Mean of 6 a. m. + 6 p. m. ÷ 2.
[5] Mean of 7 a. m. + 2 p. m. ÷ 2.
[6] Mean of readings at various hours reduced to true daily mean by special tables.
[7] Mean from hourly readings of thermograph.
[8] Mean of sunrise and noon.
[10] Mean of sunrise, noon, sunset, and midnight.

The absence of a numeral indicates that the mean temperature has been obtained from daily readings of the maximum and minimum thermometers.

An italic letter following the name of a station, as "Livingston *a*," "Livingston *b*," indicates that two or more observers, as the case may be, are reporting from the same station. A small roman letter following the name of a station, or in figure columns, indicates the number of days missing from the record; for instance "n" denotes 14 days missing.

No note is made of breaks in the continuity of temperature records when the same do not exceed two days. All known breaks, of whatever duration, in the precipitation record receive appropriate notice.

CORRECTIONS.

June, 1901, Paris, Idaho, make mean temperature read 56 5 instead of 61.5; Port Austin, Mich., cut out precipitation.

NOTE.—The following changes have been made in names of stations: New Jersey, Deckertown, changed to Sussex; Oklahoma, Prudence, changed to Lyons.

TABLE III.—*Resultant winds from observations at 8 a. m. and 8 p. m., daily, during the month of July, 1901.*

Stations.	Component direction from— N.	S.	E.	W.	Resultant. Direction from—	Duration.
	Hours.	*Hours.*	*Hours.*	*Hours.*	°	*Hours.*
New England.						
Eastport, Me	20	14	9	31	n. 75 w.	23
Portland, Me	18	23	13	22	s. 61 w.	10
Northfield, Vt	28	27	7	6	n. 45 e.	1
Boston, Mass	11	22	20	24	s. 20 w.	12
Nantucket, Mass	10	28	17	23	s. 18 w.	19
Block Island, R. I	8	23	19	26	s. 25 w.	17
New Haven, Conn	13	30	12	23	s. 33 w.	20
Middle Atlantic States.						
Albany, N. Y	19	30	8	14	s. 29 w.	12
Binghamton, N. Y †	10	3	12	13	n. 8 w.	7
New York, N. Y	13	24	20	23	s. 15 w.	11
Harrisburg, Pa †	10	3	6	18	n. 60 w.	14
Philadelphia, Pa	16	22	17	24	s. 49 w.	9
Scranton, Pa	15	23	14	25	s. 54 w.	14
Atlantic City, N. J	10	28	12	29	s. 43 w.	25
Cape May, N. J	7	32	14	23	s. 20 w.	27
Baltimore, Md	16	23	17	25	s. 49 w.	11
Washington, D. C	19	28	12	16	s. 24 w.	10
Lynchburg, Va	9	24	18	29	s. 36 w.	19
Norfolk, Va	8	38	15	14	s. 2 e.	30
Richmond, Va	15	29	12	25	s. 43 w.	19
South Atlantic States.						
Charlotte, N. C	14	28	13	25	s. 41 w	18
Hatteras, N. C	4	39	12	28	s. 25 w.	38
Raleigh, N. C	10	28	10	25	s. 40 w.	23
Wilmington, N. C	5	36	6	31	s. 39 w.	40
Charleston, S. C	8	36	5	21	s. 30 w.	32
Augusta, Ga	12	30	10	24	s. 38 w.	23
Savannah, Ga	7	37	8	25	s. 30 w.	34
Jacksonville, Fla	4	35	28	12	s. 27 e.	35
Florida Peninsula.						
Jupiter, Fla	5	26	42	3	s. 62 e.	44
Key West, Fla	7	16	50	0	s. 80 e.	51
Tampa, Fla	17	16	38	4	n. 88 e.	34
Eastern Gulf States.						
Atlanta, Ga	18	24	18	21	s. 27 w.	7
Macon, Ga †	9	16	7	4	s. 23 e.	8
Pensacola, Fla †	16	6	11	8	n. 17 e.	10
Mobile, Ala	24	24	14	16	w.	2
Montgomery, Ala	16	23	18	20	s. 16 w.	7
Meridian, Miss †	7	15	9	10	s. 7 w.	8
Vicksburg, Miss	17	24	16	22	s. 41 w.	9
New Orleans, La	17	24	17	20	s. 23 w.	8
Western Gulf States.						
Shreveport, La	10	29	29	10	s. 45 e.	27
Fort Smith, Ark	11	21	31	8	s. 67 e.	25
Little Rock, Ark	11	31	15	21	s. 17 w.	21
Corpus Christi, Tex	4	39	27	8	s. 28 e.	40
Fort Worth, Tex	3	43	21	6	s. 21 e.	43
Galveston, Tex	8	37	27	12	s. 28 e.	33
Palestine, Tex	5	41	16	10	s. 10 e.	36
San Antonio, Tex	8	34	41	1	s. 57 e.	48
Ohio Valley and Tennessee.						
Chattanooga, Tenn	15	24	18	21	s. 18 w.	10
Knoxville, Tenn	23	22	12	20	n. 83 w.	8
Memphis, Tenn	15	27	12	23	s. 43 w.	16
Nashville, Tenn	19	23	13	24	s. 70 w.	12
Lexington, Ky †	3	17	7	10	s. 12 w.	14
Louisville, Ky	15	29	17	17	s.	14
Evansville, Ind †	8	14	7	5	s. 18 e.	6
Indianapolis, Ind	23	22	15	16	n. 45 w.	1
Cincinnati, Ohio	16	23	24	16	s. 49 e	11
Columbus, Ohio	17	24	16	21	s. 36 w.	9
Pittsburg, Pa	20	15	10	32	n. 77 w.	23
Parkersburg, W. Va	19	24	14	17	s. 31 w.	6
Elkins, W. Va	21	22	12	21	s. 84 w.	9
Lower Lake Region.						
Buffalo, N. Y	11	20	19	27	s. 42 w.	12
Oswego, N. Y	15	21	16	20	s. 34 w.	7
Rochester, N. Y	14	18	16	29	s. 73 w.	14
Erie, Pa	14	11	16	34	n. 81 w.	18
Cleveland, Ohio	17	28	14	16	s. 10 w.	11
Sandusky, Ohio	13	22	19	26	s. 38 w.	11
Toledo, Ohio	13	21	16	25	s. 48 w.	12
Detroit, Mich	19	21	15	24	s. 77 w	9
Upper Lake Region.						
Alpena, Mich	19	16	21	21	n.	3
Escanaba, Mich	28	20	10	14	n. 27 w.	9
Grand Haven, Mich	14	24	17	19	s. 11 w.	10
Houghton, Mich. †	5	6	15	12	s. 72 e.	3
Marquette, Mich	21	17	15	27	n. 72 w.	13
Port Huron, Mich	24	18	17	19	n. 18 w.	6
Sault Ste. Marie, Mich	9	13	27	22	s. 51 e.	6
Chicago, Ill	17	21	23	17	s. 56 e.	7
Milwaukee, Wis	23	15	17	19	n. 14 w.	8
Green Bay, Wis	21	24	16	15	s. 18 e.	3
Duluth, Minn	33	7	29	10	n. 36 e.	32
North Dakota.						
Moorhead, Minn	22	16	29	15	n. 67 e.	15
Bismarck, N. Dak	22	11	32	9	n. 64 e.	26
Williston, N. Dak	20	20	23	8	e.	15
Upper Mississippi Valley.						
St. Paul, Minn	22	19	23	11	n. 76 e.	12
***Upper Mississippi Valley.*—Cont'd.**						
La Crosse, Wis †	7	19	6	4	s. 9 e.	12
Davenport, Iowa	9	23	27	14	s. 43 e.	19
Des Moines, Iowa	14	24	18	24	s. 31 w.	12
Dubuque, Iowa	12	32	19	14	s. 14 e.	21
Keokuk, Iowa	11	28	20	17	s. 10 e.	17
Cairo, Ill	12	33	15	22	s. 18 w.	22
Springfield, Ill	12	27	17	21	s. 15 w.	16
Hannibal, Mo †	3	16	9	13	s. 17 w.	14
St. Louis, Mo	9	26	20	18	s. 7 e.	17
Missouri Valley.						
Columbia, Mo*	8	13	10	6	s. 39 e.	6
Kansas City, Mo	10	35	15	15	s.	25
Springfield, Mo	9	41	18	9	s. 16 e.	33
Lincoln, Nebr	7	41	25	4	s. 32 e.	40
Omaha, Nebr	11	33	27	6	s. 44 e.	30
Valentine, Nebr	13	28	21	13	s. 28 e.	17
Sioux City, Iowa †	5	14	12	5	s. 38 e.	11
Pierre, S. Dak	13	28	26	5	s. 55 e.	26
Huron, S. Dak	19	20	32	9	s. 88 e.	23
Yankton, S. Dak †	4	12	9	11	s. 14 w.	8
Northern Slope.						
Havre, Mont	21	14	21	26	n. 36 w.	9
Miles City, Mont	29	14	23	8	n 45 e.	21
Helena, Mont	15	24	7	32	s. 70 w.	27
Kalispell, Mont	12	8	13	38	n. 81 w.	25
Rapid City, S. Dak	17	22	20	17	s. 31 e.	6
Cheyenne, Wyo	15	22	13	25	s 60 w.	14
Lander, Wyo	13	25	11	29	s. 56 w.	22
North Platte, Nebr	9	31	26	10	s. 36 e.	27
Middle Slope.						
Denver, Colo	14	31	11	23	s. 35 w.	21
Pueblo, Colo	26	13	12	26	n. 47 w.	19
Concordia, Kans	7	47	8	4	s. 6 e.	40
Dodge, Kans	6	58	30	4	s. 39 e.	41
Wichita, Kans	5	45	16	5	s. 15 e.	42
Oklahoma, Okla	5	48	11	6	s. 7 e.	43
Southern Slope.						
Abilene, Tex	7	35	34	4	s. 47 e.	41
Amarillo, Tex	3	45	17	13	s. 5 e.	42
Southern Plateau.						
El Paso, Tex	22	7	43	5	n. 69 e.	41
Santa Fe, N. Mex	13	21	36	2	s. 77 e.	35
Flagstaff, Ariz	28	13	3	35	n. 65 w.	35
Phoenix, Ariz	15	10	28	19	n. 61 e.	10
Yuma, Ariz	4	37	8	27	s. 30 w.	38
Independence, Cal	13	30	14	21	s. 22 w.	18
Middle Plateau.						
Carson City, Nev	4	24	5	41	s. 61 w.	40
Winnemucca, Nev	12	19	8	36	s. 76 w.	29
Modena, Utah	6	22	1	45	s. 70 w.	47
Salt Lake City, Utah	17	27	22	12	s. 45 e.	14
Grand Junction, Colo	14	17	27	20	s. 67 e.	8
Northern Plateau.						
Baker City, Oreg	22	29	12	12	s.	7
Boise, Idaho	19	23	10	29	s. 78 w.	19
Lewiston, Idaho †	2	1	29	0	n. 88 e.	29
Pocatello, Idaho	8	34	15	20	s. 11 w.	26
Spokane, Wash	6	32	17	19	s. 4 w.	26
Walla Walla, Wash	8	40	4	20	s. 27 w.	36
North Pacific Coast Region.						
Astoria, Oreg	26	17	2	37	n. 76 w.	36
Neah Bay, Wash	7	16	5	43	s. 77 w.	39
Port Crescent, Wash*	0	8	5	25	s. 81 w.	20
Seattle, Wash	19	19	13	24	w.	11
Tacoma, Wash	28	11	3	27	n 55 w.	29
Portland, Oreg	28	15	9	33	n. 62 w.	27
Roseburg, Oreg	43	3	12	15	n. 4 w.	40
Middle Pacific Coast Region.						
Eureka, Cal	29	12	6	31	n. 56 w.	30
Mount Tamalpais, Cal	20	6	2	47	n. 73 w.	47
Red Bluff, Cal	16	29	24	11	s. 45 e.	18
Sacramento, Cal	5	45	7	22	s. 21 w.	43
San Francisco, Cal	0	26	0	49	s. 62 w.	56
South Pacific Coast Region.						
Fresno, Cal	38	3	2	42	n. 49 w.	53
Los Angeles, Cal	3	15	8	46	s. 72 w.	40
San Diego, Cal	22	18	7	34	n. 82 w.	27
San Luis Obispo, Cal	16	13	4	32	n. 84 w.	28
West Indies.						
Basseterre, St. Kitts Island	17	4	53	0	n. 76 e.	54
Bridgetown, Barbados	14	9	50	2	n. 84 e.	48
Cienfuegos, Cuba	28	5	40	4	n. 58 e.	43
Grand Turk, Turks Island, W. I †	0	10	26	0	s. 69 e.	28
Havana, Cuba	5	9	53	0	s. 86 e.	53
Kingston, Jamaica	47	1	23	2	n. 25 e.	51
Port of Spain, Trinidad	10	9	44	4	n. 88 e.	40
Puerto Principe, Cuba	19	9	44	2	n. 77 e.	43
Roseau, Dominica, W. I	16	14	38	8	n. 86 e.	30
San Juan, Porto Rico	2	11	55	0	s. 81 e.	56
Santiago de Cuba, Cuba	30	12	33	2	n. 60 e.	36
Santo Domingo, S. Domingo, W. I.	......	......	......	......	......	......
Willemstad, Curaçao	5	8	56	0	s. 87 e.	56

* From observations at 8 p. m. only.

† From observations at 8 a. m. only.

TABLE IV.—*Thunderstorms and auroras, July, 1901.*

States.	No. of stations.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total. No.	Total. Days.	
Alabama	52	T.	2	9	3	4		6	4	4		1				2	6	5	8	7	5	6	5	7	4	2	1	3	4	1	1	4	7	111	26	T.
		A.																																0	0	A.
Arizona	56	T.	1	1	1		1	3	1		7	1		1	1		2	4	2	5	8	13	12	12	13	16	12	13	14	12	12	9	7	184	27	T.
		A.																																0	0	A.
Arkansas	57	T.	4	1	2	6	13	2		1				1	5	4	12	3	9	10	8	10	9	7	8	1	2	4	3	1	3	12	5	146	27	T.
		A.																																0	0	A.
California	167	T.										2	2									2	1	2	2					1	4	4	5	25	10	T.
		A.																																0	0	A.
Colorado	81	T.	7	13	1	1		1	1	13	16	11	9	1	5	6	10	3	7	6	2	3	10	15	9	22	22	19	16	8	9	12		258	30	T.
		A.																																0	0	A.
Connecticut	21	T.		10	9	1	3	4	7	1			6		1	1			5	6	2		2	3	4					2	6	7	2	82	20	T.
		A.																																0	0	A.
Delaware	5	T.		2	1			1	2	2	1				1				2	3	1	1	1	1	1		1	1					1	23	17	T.
		A.																																0	0	A.
Dist. of Columbia	4	T.	1	1	1	1		1	1	1			1					1	1	1	1						1	1		1		1		16	16	T.
		A.																																0	0	A.
Florida	47	T.	4	8	4	5	5	1	4	6	5	6	3	1	5	6	4	4	9	7	7	7	8	5	4	1		5	2	1	1		1	129	29	T.
		A.																																0	0	A.
Georgia	55	T.	16	5		1	5	4	4	6	1	1		5	5	14	10	19	12	18	13	12	9	8		1	7	13	7	7	12	8	12	235	28	T.
		A.																																0	0	A.
Idaho	34	T.		2	1				1	1	1			3	4	1		1					1	3		5	6	6	1					37	15	T.
		A.						1																										1	1	A.
Illinois	92	T.	19	24	29	20	3	1	1							3	17	4	20	7			1		2	27	13		6	27	12	19		255	21	T.
		A.		1								1	1																					3	3	A.
Indiana	58	T.	5	14	16	6	5	1								1	5	8	13	3				2	1	4	10	2	1	4	10	6		117	20	T.
		A.																																0	0	A.
Indian Territory	11	T.													1	1	3	1	1	1	2	1	1					1			1	1	1	16	13	T.
		A.																																0	0	A.
Iowa	149	T.	33	18	20	15	6			8		1	1	10	4		2	6	7	7	1			6	9	23	17	3	26	40	19	12		294	24	T.
		A.											2																					2	1	A.
Kansas	77	T.	7	10	1	11	9	2						1		4	9	13	16	12	4		1	13	7	2	2	22	26	18	26	13	1	230	24	T.
		A.																																0	0	A.
Kentucky	41	T.	6	3	8	11	2	2	1								1	3	12	3	9				2	2	4		1	6	9	5		90	19	T.
		A.																																0	0	A.
Louisiana	46	T.	8	8	12	8	8	10	5	1	3	6	2	1	12	10	4	10	9	11	7	7	9	7	9	8	7	4	7	3	5	1	7	209	31	T.
		A.																																0	0	A.
Maine	19	T.	1	14					11				2					1	7	13	1		1	4									3	58	11	T.
		A.										1																						1	1	A.
Maryland	48	T.	8	15	13	21	2	29	9	8		1	11	2		1	2	14	21	16	7		1	10	3		18	6	2		2	5	7	234	26	T.
		A.																																0	0	A.
Massachusetts	48	T.		21	7	4	4	6	5			1	15	1				3	24	16	8		15	12	2	2	1		1	4	16		2	170	22	T.
		A.																																0	0	A.
Michigan	106	T.	4	8	5	27	22	2	2		8	8			1	1	11	11	11	1	1	1	19	2	10	25	18	16	17	10	4			245	26	T.
		A.	1										1														1							3	3	A.
Minnesota	67	T.	11	4	13	27	9	1	2	11	3	5		11		4	10	6	6		2	4	1	5	9	17	20	12	20	13	3			229	26	T.
		A.											2																					2	1	A.
Mississippi	44	T.	6	8	9	2	9	10	4	2	1	2	1	3		1	5	11	12	12	4	12	8	5	8	4	2		4	1	3	3	7	159	29	T.
		A.																																0	0	A.
Missouri	95	T.	19	15	7	11	16	1		1		1		7	31	6	24	30	39	26	18	5	1	30	35	17	5	29	35	21	43	36		509	27	T.
		A.																									1	1						2	2	A.
Montana	40	T.	2	7	5	4			4	12	1	8		1	11		4	2							2	8	11	1		1				84	17	T.
		A.											1																					1	1	A.
Nebraska	142	T.	24	10	3	35	3	1	3	3	4	7	2		1	3	12	15	5	11	1		2	2	19	13	14	9	24	13	9	10		258	28	T.
		A.																																0	0	A.
Nevada	40	T.									1			1										3	4	6	2	4	2			4	7	34	10	T.
		A.																																0	0	A.
New Hampshire	19	T.		7	1	1	2	6	7				2						13	12	2		1	2								2	2	60	14	T.
		A.											1																					1	1	A.
New Jersey	51	T.		25	27	16	19	28	16	14		1	11		2	6	7	12	22	15	11			4	15	3	5	1		13	23	11	18	325	25	T.
		A.																																0	0	A.
New Mexico	31	T.	9	6	4	1	3	4	2	1			1	3	7	8	5	9	10	8	7	5	6	7	8	10	10	8	10	6	10	4	6	178	29	T.
		A.																																0	0	A.
New York	99	T.	1	18	16	22	26	30	19	5			4	1	1		2				3	3	17	10	3	5	1	3	1	38	37	14	5	285	25	T.
		A.																																0	0	A.
North Carolina	56	T.	5	9	7	1	2	18	8	16	6	2	3	6		17	16	20	10	16	12	7	2	1	8	8	7	12	10	7	6	10	13	265	30	T.
		A.																																0	0	A.
North Dakota	48	T.		3	6	8	1		2		2	2	3		1	4	2		1					5	3	2	3	2		4	1			55	21	T.
		A.											1	1																				2	2	A.
Ohio	128	T.	20	14	32	46	37	6		1		1	8	1		6	28	25	38	15			1	12	2	11	21	28	10	3	26	13	6	411	5	T.
		A.				1									1	1				1						1			1		1			7	7	A.
Oklahoma	23	T.						1								2	3	3	1	2	4	1	2	5		2	3	4	2	1	3	3	1	43	18	T.
		A.																																0	0	A.
Oregon	74	T.		2								1			2	1						1			1		1					1		10	8	T.
		A.																																0	0	A.
Pennsylvania	91	T.	1	1	20	18	6	18	11	5			17	1	2	3	12	24	28	11	1		1	8	3		10	15	5	8	18	8	20	275	27	T.
		A.																																0	0	A.
Rhode Island	7	T.		4	3		1		1										2	1	5		1	2	1						1			22	11	T.
		A.																																0	0	A.
South Carolina	46	T.	5	1			1	3	3	7	2		2	2	5	12	12	13	11	15	12	7	4	5			6	10	10	4	2	5	12	171	26	T.
		A.																																0	0	A.
South Dakota	56	T.	6	4		8	1		4	3	3	1	1	1		5	7	4	4	4						7	6	11	7	11	6			104	21	T.
		A.																																0	0	A.
Tennessee	56	T.	8	9	6	4	4	12	8	3					1	2	5	5	15	8	1		4	1	2	2	3	4	3	4	4	8	4	130	26	T.
		A.																																0	0	A.
Texas	95	T.			1	2	3	7	4	1	4	4	2	1	1	4			1	3	6	3	9	6	3	4	5	6	1	2	2	2	6	98	27	T.
		A.																																0	0	A.
Utah	47	T.	1							9	14	13	1	2								1	13	13	10	11	9	9	5	3	6	8	8	136	18	T.
		A.																																0	0	A.
Vermont	16	T.	1	4		1	1	2	8										9	8			2								1	1		38	11	T.
		A.																																0	0	A.
Virginia	50	T.	4	14	9	9	7	15		10	2		5	2	3	5	8	9	14	12	7	2			3	2	6	9	1	2	4	5	11	180	27	T.
		A.																																0	0	A.
Washington	64	T.	2	5					1				1		5	1																1		16	7	T.
		A.																																0	0	A.
West Virginia	43	T.	15	7	19	19	7	20	12	3	1		4	2	2	4	13	18	14	8	6	2	2	6	1		5	5	4		2	1	8	210	28	T.
		A.																																0	0	A.
Wisconsin	60	T.	13	12	14	24	9			1	11	1		4	1		1	1	20			2	4	2	13	24	24	21	9	6	1			218	23	T.
		A.																																0	0	A.
Wyoming	31	T.	2	3		1			1	7	10	3	2	1	1		8		5				1	3	4	5	6	6	1					70	19	T.
		A.																																0	0	A.
Sums	2,893	T.	281	379	336	402	255	250	179	167	107	91	122	77	122	149	282	321	476	340	189	118	188	256	247	302	327	328	298	307	373	259	195	7,732	....	T.
		A.	1	1	0	1	0	1	0	0	0	2	9	1	1	1	0	0	0	1	0	0	0	0	0	1	1	1	2	0	1	0	0	25	....	A.

TABLE V.—*Accumulated amounts of precipitation for each 5 minutes, for storms in which the rate of fall equaled or exceeded 0.25 in any 5 minutes, or 0.75 in 1 hour during July, 1901, at all stations furnished with self-registering gages.*

Stations.	Date.	Total duration. From—	Total duration. To—	Total am't of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive began.	Depths of precipitation (in inches) during periods of time indicated. 5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Albany, N. Y.	6			0.68								0.58									
Alpena, Mich.	5			0.67														0.65			
Atlanta, Ga.	18	6.30 p.m.	8.45 p.m.	1.99	7.14 p.m.	8.25 p.m.	0.02	0.21	0.36	0.39	0.49	0.57	0.70	0.86	1.11	1.27	1.32	1.64	1.96		
Do	26	6.12 p.m.	8.52 p.m.	1.33	6.19 p.m.	7.05 p.m.	T.	0.09	0.30	0.38	0.47	0.57	0.66	0.84	0.92	1.07	1.12	1.20	1.31		
Atlantic City, N. J.	19			0.46													0.46				
Baltimore, Md.	25	6.00 p.m.	7.00 p.m.	1.95	6.00 p.m.	6.35 p.m.	0.00	0.31	0.80	1.18	1.54	1.77	1.85	1.91	1.94						
Binghamton, N. Y.	5	8.54 a.m.	11.40 a.m.	1.24	9.50 a.m.	10.20 a.m.	0.02	0.04	0.25	0.55	0.90	0.99	1.04	1.06	1.10	1.17	1.21				
Bismarck, N. Dak.	24-25			0.93														0.64			
Boise, Idaho	25			T.																	
Boston, Mass.	29			0.81														0.37			
Buffalo, N. Y.	5	8.05 p.m.	9.15 p.m.	1.18	8.15 p.m.	8.45 p.m.	0.02	0.23	0.53	0.83	0.93	1.01	1.10	1.11	1.15						
Cairo, Ill.	5	10.42 a.m.	1.35 p.m.	1.21	10.59 a.m.	11.30 a.m.	0.01	0.08	0.12	0.16	0.42	0.70	0.90	0.93							
Do	30	1.07 a.m.	8.10 a.m.	3.23	6.15 a.m.	7.30 a.m.	1.21	0.25	0.44	0.47	0.59	0.76	0.85	1.01	1.21	1.43	1.54	1.54	2.00		
Charleston, S. C.	9	2.52 p.m.	5.23 p.m.	1.57	3.05 p.m.	4.05 p.m.	0.05	0.08	0.15	0.28	0.39	0.53	0.59	0.66	0.75	1.07	1.16	1.48			
Chicago, Ill.	1	1.32 p.m.	5.45 p.m.	1.56	3.14 p.m.	3.35 p.m.	0.40	0.29	0.57	0.77	0.98	1.04	1.07								
Cincinnati, Ohio	30	6.10 p.m.	10.05 p.m.	1.22	6.30 p.m.	7.00 p.m.	0.01	0.19	0.32	0.40	0.48	0.59	0.73	0.76	0.81						
Cleveland, Ohio	4	7.40 p.m.	D. N.	1.54	7.50 p.m.	8.35 p.m.	T	0.07	0.44	0.74	0.96	1.12	1.20	1.28	1.34	1.39					
Columbia, Mo.	17			0.92														0.64			
Columbus, Ohio	15			0.56														0.47			
Denver, Colo.	27			0.01														0.01			
Des Moines, Iowa	1	3.15 p.m.	5.15 p.m.	0.78	3.18 p.m.	3.30 p.m.	T.	0.49	0.64	0.73											
Detroit, Mich.	26-27	10.45 p.m.	5.40 a.m.	1.61	12.15 a.m.	12.50 a.m.	0.16	0.08	0.15	0.20	0.24	0.40	0.60	0.67							
Dodge, Kans	28			1.02														*			
Duluth, Minn.	4			1.18														*			
Eastport, Me.	16			0.15														0.15			
Elkins, W. Va	6			0.64														0.54			
Erie, Pa.	16			0.73														0.47			
Escanaba, Mich.	5	D. N.	7.40 a.m.	1.81	4.20 a.m.	4.55 a.m.	0.31	0.12	0.26	0.37	0.48	0.62	0.73	0.81							
Evansville, Ind	30			0.16									0.16								
Fort Worth, Tex.	31	8.15 p.m.	11 45 p.m.	0.77	8.18 p.m.	8.45 p.m.	T.	0.06	0.10	0.20	0.37	0.58	0.63								
Fresno, Cal.	30			T.																	
Galveston, Tex.	22	6.10 a.m.	2.10 p.m.	3.07	10.30 a.m.	11.15 a.m.	0.40	0.24	0.74	1.16	1.54	1.94	2.20	2.35	2.48	2.52	2.55				
Grand Junction, Colo.	10			0.06						0.04											
Harrisburg, Pa.	11			0.35														0.35			
Hatteras, N. C.	10-11	7.00 a.m.	6.55 a.m.	4.11	12.50 a.m.	1.40 a.m.	1.38	0.06	0.11	0.16	0.22	0.29	0.36	0.43	0.50	0.56	0.62				
					1.40 a.m.	2.30 a.m.		0.65	0.69	0.73	0.81	0.87	0.94	1.00	1.07	1.16	1.24				
					2.30 a.m.	4.30 a.m.		1.30	1.37	1.42	1.50	1.58	1.65	1.74	1.83	1.91	1.97	2.08	2.24	2.44	2.64
Huron, S. Dak.	28			0.14					0.14												
Indianapolis, Ind.	17			0.71														0.40			
Jacksonville, Fla.	1	3.40 p.m.	8.10 p.m.	1.26	3.55 p.m.	4.35 p.m.	0.01	0.06	0.33	0.52	0.70	0.84	1.00	1.12	1.17	1.20					
Jupiter, Fla.	6	2.35 p.m.	7.10 p.m.	1.44	4.30 p.m.	4.55 p.m.	0.62	0.06	0.17	0.34	0.59	0.74									
Kalispell, Mont	3			0.33														0.17			
Kansas City, Mo.	29			1.16														0.48			
Key West, Fla.	22	7.02 a.m.	1.25 p.m.	1.79	10.15 a.m.	10.50 a.m.	0.79	0.26	0.48	0.65	0.71	0.79	0.86	0.93	0.95						
Knoxville, Tenn	6			0.47														0.27			
Lexington, Ky.	3	2.10 p.m.	2.50 p.m.	0.79	2.13 p.m.	2.30 p.m.	T.	0.32	0.64	0.72	0.76	0.78									
Lincoln, Nebr.	1-2	4.35 p.m.	D. N.	1.49	4.40 p.m.	5.30 p.m.	T.	0.16	0.22	0.34	0.49	0.55	0.61	0.79	0.95	1.04	1.15	1.20			
Little Rock, Ark.	5			0.49														0.49			
Los Angeles, Cal.	3			T.																	
Louisville, Ky.	3	4.30 p.m.	5.07 p.m.	0.95	4.30 p.m.	5.05 p.m.	0.00	0.15	0.33	0.39	0.57	0.81	0.90	0.95							
		6.31 p.m.	10.05 p.m.	1.38	6.31 p.m.	7.05 p.m.	0.00	0.10	0.26	0.47	0.67	0.89	1.10	1.18	1.20	1.22	1.24				
Macon, Ga.	15			0.50										0.50							
Memphis, Tenn.	30			0.34														0.34			
Meridian, Miss.	25	1.20 p.m.	2.33 p.m.	0.74	1.39 p.m.	2.05 p.m.	T.	0.33	0.44	0.49	0.59	0.66	0.69	0.72							
Milwaukee, Wis.	3			0.80														0.62			
Montgomery, Ala	2			0.56														0.51			
Nantucket, Mass.	29			0.18					0.10												
Nashville, Tenn.	18	1.45 p.m.	3.05 p.m.	0.82	1.57 p.m.	2.20 p.m.	T.	0.19	0.47	0.62	0.73	0.78	0.80								
Do	30	10.53 a.m.	2.40 p.m.	1.07	11.32 a.m.	12.10 p.m.	0.08	0.13	0.26	0.46	0.57	0.68	0.75	0.80	0.84						
New Haven, Conn.	3	1.58 p.m.	2.40 p.m.	1.06	2.05 p.m.	2.30 p.m.	0.03	0.16	0.56	0.85	0.95	1.01									
New Orleans, La.	15-16	10.50 p.m.	12.25 a.m.	1.53	11.05 p.m.	11.45 p.m.	0.02	0.05	0.09	0.14	0.23	0.43	0.91	1.27	1.35	1.38	1.41	1.51			
Do	18	4.05 p.m.	8.30 p.m.	1.88	4.10 p.m.	4.40 p.m.	0.02	0.19	0.50	0.83	1.28	1.51	1.56	1.59							
Do	19	11.45 a.m.	4.55 p.m.	2.19	12.30 p.m.	1.15 p.m.	0.02	0.10	0.44	0.62	0.82	1.23	1.54	1.77	1.91	2.00	2.03				
New York, N. Y.	5	2.08 p.m.	4.29 p.m.	2.02	2.08 p.m.	3.25 p.m.	T.	0.38	0.63	0.80	0.89	1.02	1.07	1.07	1.07	1.08	1.16	1.29	1.70	1.79	2.01
Norfolk, Va.	8	2.56 p.m.	6.05 p.m.	0.90	2.56 p.m.	3.50 p.m.	0.00	0.23	0.33	0.33	0.33	0.33	0.34	0.39	0.45	0.57	0.78	0.86			
Northfield, Vt.	28	D. N.	5.35 p.m.	2.10	12.40 p.m.	1.40 p.m.	0.65	0.08	0.14	0.19	0.28	0.38	0.44	0.48	0.55	0.62	0.67	0.77			
Oklahoma, Okla.	24			0.02														0.02			
Omaha, Nebr.	16			0.78														0.69			
Parkersburg, W. Va.	15			0.27														0.19			
Philadelphia, Pa.	4	7.48 p.m.	8.32 p.m.	0.54	8.00 p.m.	8.15 p.m.	T.	0.18	0.43	0.51	0.53										
Do	25	7.30 p.m.	9.45 p.m.	0.88	7.45 p.m.	8.10 p.m.	T.	0.12	0.23	0.32	0.45	0.51	0.54	0.57							
Pittsburg, Pa.	31			0.79														0.65			
Pocatello, Idaho	12			T.																	
Portland, Me.	17			0.58														0.53			
Portland, Oreg.	2			0.09														0.08			
Pueblo, Colo.	2	7.30 p.m.	9.45 p.m.	0.57	7.33 p.m.	7.48 p.m.	T.	0.27	0.43	0.51	0.53	0.55									
Raleigh, N. C.	8	2.30 p.m.	3.15 p.m.	0.90	2.40 p.m.	3.00 p.m.	T.	0.07	0.34	0.60	0.87	0.88									
Richmond, Va.	12-13	9.15 p.m.	7.40 a.m.	1.55	12.25 a.m.	12.50 a.m.	0.54	0.23	0.45	0.54	0.58	0.64	0.66								
Rochester, N. Y.	5-6			1.04														*			
St. Louis, Mo.	2	4.37 p.m.	6.10 p.m.	0.81	4.43 p.m.	5.25 p.m.	T.	0.14	0.26	0.29	0.42	0.47	0.52	0.66	0.74	0.80					
Do	3	4.38 p.m.	5.28 p.m.	0.63	4.39 p.m.	5.00 p.m.	T.	0.15	0.35	0.50	0.55	0.56									
St. Paul, Minn.	16			0.30									0.30								
Salt Lake City, Utah	10			0.27									0.27								
San Diego, Cal.	31			T.																	
Sandusky, Ohio	26			0.62														0.38			
San Francisco, Cal.	30			T.																	
Savannah, Ga.	8	7.28 a.m.	6.35 p.m.	1.57	7.40 a.m.	8.10 a.m.	0.01	0.05	0.25	0.58	0.64	0.72	0.85	0.89	0.92						
Seattle, Wash.	22			0.11														0.06			
Spokane, Wash.	3			0.41														0.11			
Springfield, Ill.	4			0.42									0.42								
Tampa, Fla.	2			2.22														1.80*			
Toledo, Ohio	4-5	6.02 p.m.	7.45 a.m.	1.16	6.15 p.m.	6.45 p.m.	T.	0.13	0.36	0.51	0.62	0.66	0.72	0.74	0.77						
Do	26	1.00 a.m.	D. N.	0.61	1.05 a.m.	1.20 a.m.	0.01	0.19	0.39	0.50	0.53	0.56									
Topeka, Kans.	27	6.15 a.m.	8.35 a.m.	1.74	6.25 a.m.	8.05 a.m.	0.02	0.12	0.22	0.26	0.28	0.32	0.47	0.67	0.74	0.76	0.79	0.90	1.27	1.70	
Do	28	5.15 a.m.	7.00 a.m.	1.49	6.15 a.m.	6.45 a.m.	0.36	0.09	0.37	0.64	0.90	1.07	1.10								
Vicksburg, Miss.	21	1.17 p.m.	5.40 p.m.	1.12	3.05 p.m.	3.47 p.m.	0.14	0.05	0.14	0.39	0.61	0.68	0.69	0.70	0.89	0.96					
Washington, D. C.	6	4.10 p.m.	7.30 p.m.	0.69	4.23 p.m.	4.40 p.m.	T.	0.14	0.36	0.47	0.52	0.55									
Wilmington, N. C.	8-9	11.20 p.m.	11.55 a.m.	2.74	11.40 p.m.	12.30 a.m.	0.05	0.07	0.14	0.19	0.29	0.40	0.51	0.64	0.73	0.85	0.93	0.97			
Do	13-14	9.25 p.m.	10.20 a.m.	0.98	9.15 a.m.	9.50 a.m.	0.24	0.07	0.10	0.17	0.35	0.44	0.47	0.64							
Do	31	8.20 p.m.	11.50 p.m.	1.66	9.25 p.m.	10.15 p.m.	0.60	0.14	0.23	0.31	0.35	0.35	0.38	0.49	0.67	0.94	1.00				

TABLE V.—*Accumulated amounts of precipitation for each 5 minutes, etc.*—Continued.

Stations.	Date.	Total duration. From—	Total duration. To—	Total am't of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive began.	5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
1		2	3	4	5	6	7														
Yankton, S. Dak	28	...	...	0.48	...	...	...	...	...	...	...	...	...	...	...	...	...	0.48	...	...	...
Basseterre, St. Kitts	21	3.55 p.m.	4.35 p.m.	1.38	3.55 p.m.	4.25 p.m.	0.00	0.24	0.56	0.77	1.03	1.24	1.33	1.35	...	...	...	...	...	...	...
Bridgetown, Barbados	5-6	3.55 p.m.	7.03 a.m.	4.46	4.50 p.m.	5.50 p.m.	0.09	0.09	0.25	0.35	0.44	0.58	0.84	1.03	1.19	1.31	1.47	1.62	...	...	...
					6.40 p.m.	7.15 p.m.	2.12	0.25	0.44	0.57	0.71	0.94	1.05	1.13	1.15	1.19	1.27	1.47	...	...	...
Do	20	8.55 a.m.	11.40 a.m.	1.42	11.05 a.m.	11.30 a.m.	0.56	0.06	0.20	0.36	0.71	0.86	...	...	...	...	...	...	...	...	...
Cienfuegos, Cuba	11	5.21 p.m.	10.00 p.m.	1.93	6.05 p.m.	6.40 p.m.	0.54	0.10	0.27	0.62	0.90	1.05	1.13	1.21	...	...	...	...	...	...	...
Do	24	12.52 p.m.	2.15 p.m.	1.13	1.08 p.m.	1.35 p.m.	0.02	0.22	0.50	0.86	0.91	0.96	1.01	1.03	1.09	...	...	...	...	...	...
Havana Cuba	8	3.35 p.m.	5.10 p.m.	2.78	3.55 p.m.	5.00 p.m.	T.	0.16	0.46	0.58	0.72	0.96	1.23	1.36	1.65	2.01	2.19	2.66	2.78	...	...
Do	30	1.05 p.m.	2.50 p.m.	1.75	1.14 p.m.	2.34 p.m.	T.	0.06	0.13	0.22	0.34	0.38	0.47	0.71	1.08	1.16	1.22	1.47	1.74	...	...
Kingston, Jamaica	5-6	10.43 a.m.	7.15 a.m.	3.18	11.40 a.m.	1.15 p.m.	0.31	0.16	0.31	0.42	0.49	0.57	0.69	0.76	0.81	0.86	0.89	0.94	1.17	1.42	...
Do	24	6.46 p.m.	8.42 p.m	1.39	6.57 p.m.	7.40 p.m.	T.	0.25	0.37	0.39	0.45	0.65	0.75	0.98	1.11	1.17	1.20	1.28	1.38	...	...
Port of Spain, Trin	31	11.19 a.m.	3.30 p.m.	1.80	12.15 p.m.	12.35 p.m.	0.20	0.15	0.48	0.73	0.90	0.93	...	...	...	...	...	...	...	...	...
					2.00 p.m.	2.12 p.m.	1.18	0.27	0.50	0.53	...	...	...	...	...	...	...	...	...	...	...
Puerto Principe, Cuba	3	3.45 p.m.	6.40 p.m.	1.42	4.25 p.m.	5.00 p.m.	T.	0.13	0.28	0.36	0.42	0.51	0.65	0.84	...	...	...	...	...	...	...
Do	19	5.17 p.m.	10.45 p.m.	2.42	5.20 p.m.	6.10 p.m.	T.	0.11	0.23	0.35	0.50	0.71	1.07	1.76	1.90	1.99	2.08	2.13	...	...	...
Roseau, Dominica	2	11.15 a.m.	1.15 p.m.	0.95	12.08 p.m.	1.00 p.m.	0.07	0.17	0.28	0.37	0.40	0.42	0.46	0.58	0.69	0.76	0.87	0.89	...	...	...
Do	6	D. N.	11.45 a.m.	3.30	8.50 a.m.	10.25 a.m.	0.99	0.30	0.33	0.35	0.42	0.45	0.62	0.65	0.76	0.99	1.10	1.12	1.55	1.87	...
San Juan, Porto Rico	3	4.30 a.m.	5.25 a.m.	0.73	5.07 a.m.	5.22 a.m.	0.04	0.16	0.43	0.69	...	...	...	...	...	...	...	...	...	...	...
Do	6-7	7.57 p.m.	D. N.	1.33	1.25 a.m.	1.57 a.m.	0.46	0.05	0.24	0.35	0.46	0.51	0.73	0.86	...	...	...	...	...	...	...
Do	7	D. N.	3.35 p.m.	2.71	9.55 a.m.	11.15 a.m.	0.29	0.06	0.12	0.17	0.26	0.30	0.31	0.34	0.37	0.46	0.65	1.10	1.39	...	...
Do	23	D. N.	4.45 p.m.	1.39	5.15 a.m.	5.50 a.m.	0.10	0.09	0.26	0.35	0.44	0.51	0.60	0.66	...	...	...	...	...	...	...
Santiago de Cuba	4	3.03 p.m.	4.10 p.m.	0.95	3.24 p.m.	3.57 p.m.	0.01	0.15	0.36	0.55	0.70	0.88	0.94	...	...	...	...	...	...	...	...
Do	5	5.10 a.m.	4.20 p.m.	6.26	6.05 a.m.	6.55 a.m.	0.24	0.05	0.09	0.15	0.22	0.30	0.39	0.48	0.64	0.75	0.83	...	...	...	...
					6.55 a.m.	7.45 a.m.	...	0.89	1.02	1.15	1.29	1.45	1.57	1.66	1.74	1.83	1.91	...	...	...	...
					7.45 a.m.	9.15 a.m.	...	1.98	2.19	2.39	2.52	2.71	2.81	2.84	2.91	2.98	3.12	3.31	3.72	3.93	4.11
Santo Domingo, W.I.	3-5	9.55 p.m.	D. N.	4.80	2.10 p.m.	3.20 p.m.	1.77	0.11	0.19	0.40	0.48	0.51	0.52	0.59	0.71	0.82	0.92	1.19	1.35	...	...
Do	6	12.04 p.m.	1.50 p.m.	1.29	12.05 p.m.	12.40 p.m.	0.01	0.17	0.34	0.45	0.61	0.75	1.01	1.18	1.20	...	...	...	...	...	...
Do	23	12.22 p.m.	2.00 p.m.	0.99	12.22 p.m.	12.55 p.m.	0.00	0.18	0.31	0.36	0.48	0.68	0.83	0.88	0.91	...	...	...	...	...	...
Willemstad, Curaçao	24-25	...	...	0.84	...	...	...	...	...	...	...	...	...	...	...	...	...	0.55	...	...	...

*Self register not working.

TABLE VI.—*Data furnished by the Canadian Meteorological Service, July*, 1901.

Stations.	Pressure. Mean not reduced.	Pressure. Mean reduced.	Pressure. Departure from normal.	Temperature. Mean.	Temperature. Departure from normal.	Temperature. Mean maximum.	Temperature. Mean minimum.	Precipitation. Total.	Precipitation. Departure from normal.	Precipitation. Depth of snow.
	Ins.	Ins.	Ins.	°	°	°	°	Ins.	Ins.	Ins.
St. Johns, N. F	...	...	...	...	...	...	...	...	...	
Sydney, C. B. I	29.87	29.91	.00	65.0	+ 2.7	75.9	54.2	1.40	−3.10	
Halifax, N. S	29.82	29.93	+.01	67.5	+ 4.1	77.8	57.1	1.58	−2.67	
Grand Manan, N. B	29.87	29.92	−.01	65.0	+ 3.3	73.3	56.6	1.12	−2.72	
Yarmouth, N. S	29.88	29.96	+.03	62.6	+ 3.1	70.9	54.3	2.75	−0.32	
Charlottet'n, P. E. I	29.86	29.90	−.02	68.3	+ 4.2	78.4	58.3	1.25	−2.72	
Chatham, N. B	29.85	29.87	−.01	67.6	+ 2.6	78.9	56.3	1.51	−3.19	
Father Point, Que	29.81	29.84	−.01	57.9	+ 0.3	66.8	49.0	1.08	−2.14	
Quebec, Que	29.58	29.90	+.03	67.6	+ 2.1	77.9	57.3	3.45	−0.51	
Montreal, Que	29.72	29.92	+.04	71.0	+ 2.5	79.2	62.8	5.27	+0.70	
Bissett, Ont	29.35	29.94	+.05	67.0	+ 1.4	81.9	52.1	2.15	−0.97	
Ottawa, Ont	...	...	...	71.8	+ 2.3	82.3	61.4	3.18	−0.19	
Kingston, Ont	29.62	29.93	+.03	70.6	+ 2.4	77.5	63.7	3.56	+0.30	
Toronto, Ont	29.57	29.94	.00	73.8	+ 5.8	84.2	63.3	3.37	+0.40	
White River, Ont	28.66	29.97	+.01	63.2	+ 3.7	77.1	49.3	3.30	−0.01	
Port Stanley, Ont	29.34	29.96	.00	72.6	+ 4.8	82.4	62.7	3.69	+0.14	
Saugeen, Ont	29.26	29.95	+.02	69.9	+ 5.2	78.2	61.5	4.30	+2.27	
Parry Sound, Ont	29.26	29.93	+.01	69.5	+ 3.5	79.2	59.7	7.90	+5.47	
Port Arthur, Ont	29.24	29.92	+.03	64.0	+ 2.0	73.5	54.6	6.24	+3.23	
Winnipeg, Man	29.10	29.89	−.01	69.2	+ 3.2	80.2	58.3	3.12	−0.10	
Minnedosa, Man	28.14	29.88	+.03	67.0	+ 4.8	77.7	56.3	2.25	−0.29	
Qu'Appelle, Assin	27.67	29.85	−.02	66.2	+ 2.7	77.3	55.1	5.47	+3.02	
Medicine Hat, Assin	...	...	...	...	...	...	...	...	...	
Swift Current, Assin	...	...	...	...	...	...	...	...	...	
Calgary, Alberta	26.38	29.83	−.08	58.9	− 1.7	72.2	45.6	3.90	+1.32	
Banff, Alberta	25.36	29.90	−.01	55.5	− 1.1	70.0	41.1	2.84	−0.40	
Edmonton, Alberta	27.60	29.84	−.07	60.9	+ 0.3	71.5	50.3	11.13	+8.03	
Prince Albert, Sask	28.31	29.80	−.07	63.1	+ 1.2	73.6	52.6	4.49	+2.78	
Battleford, Sask	28.17	29.85	−.03	63.6	− 1.1	74.7	52.5	1.96	−0.32	
Kamloops, B. C	28.66	29.90	−.05	67.1	− 1.4	81.3	53.0	0.42	−0.63	
Victoria, B. C	29.93	30.03	−.02	57.4	− 2.6	63.9	50.9	0.19	−0.21	
Barkerville, N. W. T.	25.66	29.90	...	51.9	− 3.2	64.2	39.6	3.38	+0.34	
Hamilton, Bermuda	29.97	30.13	+.02	81.7	+ 3.3	88.7	74.7	2.42	−2.36	

TABLE VII.—*Heights of rivers referred to zeros of gages, July, 1901.*

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Mississippi River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
St. Paul, Minn	1,954	14	7.2	11-13	3.9	30,31	6.0	3.3
Reeds Landing, Minn	1,884	12	5.8	10,11	3.0	31	4.7	2.8
La Crosse, Wis	1,819	12	7.2	11-14	4.6	31	6.3	2.6
Prairie du Chien, Wis	1,759	18	7.2	14,15	4.4	31	6.0	2.8
Dubuque, Iowa	1,699	15	7.3	14-17	4.8	31	6.2	2.5
Leclaire, Iowa	1,609	10	4.5	17-19	2.9	1,2	3.8	1.6
Davenport, Iowa	1,593	15	5.4	16-19	3.6	1-4	4.6	1.8
Muscatine, Iowa	1,562	16	6.5	17-20	4.7	2-4	5.7	1.8
Galland, Iowa	1,472	8	2.9	19,20	2.0	1-8	2.4	0.9
Keokuk, Iowa	1,463	15	4.6	18-22	2.9	1-5	3.8	1.7
Hannibal, Mo	1,402	13	5.4	21	3.7	6,7	4.6	1.7
Grafton, Ill	1,306	23	6.8	23,24	5.5	8,9	6.1	1.3
St. Louis, Mo	1,264	30	14.1	1	8.2	30,31	10.7	5.9
Chester, Ill	1,189	36	11.5	1	6.2	31	8.3	5.3
New Madrid, Mo	1,003	34	22.8	2,3	9.7	31	14.7	13.1
Memphis, Tenn	843	33	19.2	4,5	5.8	31	11.3	13.4
Helena, Ark	767	42	26.8	5,6	10.4	31	17.9	16.4
Arkansas City, Ark	635	42	27.3	7	10.5	31	18.5	16.8
Greenville, Miss	595	42	22.4	7,8	8.7	31	15.4	13.7
Vicksburg, Miss	474	45	24.8	9	9.0	31	17.5	15.8
New Orleans, La	108	16	8.2	10	4.3	30,31	6.0	3.9
Missouri River.								
Bismarck, N. Dak	1,309	14	7.8	8	4.0	30,31	5.7	3.8
Pierre, S. Dak	1,114	14	9.0	1	5.4	31	6.8	3.6
Sioux City, Iowa	784	19	12.5	3	8.4	31	10.3	4.1
Omaha, Nebr	669	18	12.4	4	9.1	31	10.4	3.3
Plattsmouth, Nebr	641	18	7.4	6	4.4	31	5.8	3.0
St. Joseph, Mo	481	10	7.7	6	4.0	24	5.4	3.7
Kansas City, Mo	388	21	16.7	6	10.2	25,26	12.6	6.5
Boonville, Mo	199	20	13.4	1	7.9	31	10.5	5.5
Hermann, Mo	103	24	12.4	1	6.8	28,29	9.1	5.6
Illinois River.								
Peoria, Ill	135	14	6.6	4-9	5.5	26-28	6.2	1.1
Youghiogheny River.								
Confluence, Pa	59	10	1.8	19	0.8	11,30,31	1.2	1.0
West Newton, Pa	15	23	1.7	18,19	0.3	14,15,28, 29,31	0.6	1.4
Allegheny River.								
Warren, Pa	177	14	0.9	1	0.2	23-26,28-30	0.4	0.7
Oil City, Pa	123	13	1.4	1,2	0.6	17,18	1.0	0.8
Parker, Pa	73	20	1.7	6,7	0.7	25-27	1.1	1.0
Monongahela River.								
Weston, W. Va	161	18	1.4	7	−0.4	3,4,15, 16,28-31	−0.1	1.8
Fairmont, W. Va	119	25	2.8	1	0.2	31	1.3	2.6
Greensboro, Pa	81	18	10.1	17	6.4	30,31	7.4	3.7
Lock No. 4, Pa	40	28	10.1	18	5.7	26	6.8	4.4
Conemaugh River.								
Johnstown, Pa	64	7	2.5	2	1.4	29-31	1.8	1.1
Red Bank Creek.								
Brookville, Pa	35	8	0.2	1-9	−0.5	15-31	−0.2	0.7
Beaver River.								
Ellwood Junction, Pa	10	14	4.0	4,5	1.9	26-31	2.8	2.1
Great Kanawha River.								
Charleston, W. Va	58	30	8.7	16	4.5	25	6.6	4.2
Little Kanawha River.								
Glenville, W. Va	103	20	3.8	7	−1.8	31	1.0	5.6
New River.								
Hinton, W. Va	95	14	6.6	15	2.1	31	3.4	4.5
Cheat River.								
Rowlesburg, W. Va	36	14	5.0	17	1.0	31	2.7	4.0
Ohio River.								
Pittsburg, Pa	966	22	7.6	18	0.6	15	3.8	7.0
Davis Island Dam, Pa	960	25	5.8	1	2.4	30	3.8	3.4
Wheeling, W. Va	875	36	7.9	1	2.2	31	4.4	5.7
Parkersburg, W. Va	785	36	7.6	2	2.8	31	5.6	4.8
Point Pleasant, W. Va	703	39	12.6	1	2.8	30	6.9	9.8
Huntington, W. Va	660	50	16.7	1	5.3	29,30	10.4	11.4
Catlettsburg, Ky	651	50	16.5	1	2.5	30,31	9.3	14.0
Portsmouth, Ohio	612	50	18.0	1	5.1	31	10.9	12.9
Cincinnati, Ohio	499	50	23.8	1	7.4	31	13.1	16.4
Madison, Ind	413	46	22.9	1	7.8	31	12.0	15.1
Louisville, Ky	367	28	10.1	1	4.8	31	6.4	5.3
Evansville, Ind	184	35	25.8	1	6.7	23	11.2	19.1
Paducah, Ky	47	40	21.4	2	4.6	31	9.8	16.8
Cairo, Ill	1,073	45	28.4	2	10.4	31	17.0	18.0
Muskingum River.								
Zanesville, Ohio	70	20	8.5	5	5.8	26,27,31	6.6	2.7
Scioto River.								
Columbus, Ohio	110	17	8.5	5	2.0	30,31	3.1	6.5
Miami River.								
Dayton, Ohio	77	18	1.6	4	0.7	31	1.1	0.9
Wabash River.								
Mount Carmel, Ill	50	15	7.6	1	1.2	29-31	2.7	6.4
Licking River.								
Falmouth, Ky	30	25	5.0	2	0.9	27-30	1.8	4.1
Kentucky River.								
Frankfort, Ky	65	31	7.0	1,4,8,9	5.2	24-31	6.0	1.8
Clinch River.								
Speers Ferry, Va	156	20	5.3	7	−0.4	29,30	0.7	5.7
Clinton, Tenn	52	25	9.4	9	2.6	30,31	4.9	6.8
Tennessee River.								
Knoxville, Tenn	635	29	4.9	9	1.4	27,30	2.8	3.5
Kingston, Tenn	556	25	4.3	3	1.7	31	2.7	2.6
Chattanooga, Tenn	452	33	6.6	11	2.8	29-31	4.5	3.8
Bridgeport, Ala.*	402	24	4.8	11	1.4	28-31	2.4	3.4
Florence, Ala	255	16	5.0	1	1.0	31	2.7	4.0
Riverton, Ala	225	25	6.5	1	0.5	31	3.0	6.0
Tennessee River—Cont'd.	*Miles.*	*Feet*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Johnsonville, Tenn	95	24	8.2	1	2.2	31	4.3	6.0
Cumberland River.								
Burnside, Ky	516	50	3.2	6	1.0	29,30	2.0	2.2
Carthage, Tenn	305	40	3.4	1,2	0.6	29,30	1.8	2.8
Nashville, Tenn	189	40	5.8	1	1.4	28-30	2.9	4.4
Clarksville, Tenn	126	42	8.1	1	1.7	30	4.1	6.4
Arkansas River.								
Wichita, Kans	832	10	1.9	1,2	1.3	21-31	1.4	0.6
Webbers Falls, Ind. T	465	23	1.9	1	1.6	6-8,13-31	1.6	0.3
Fort Smith, Ark	403	22	1.8	1-5	0.6	28-31	1.2	1.2
Dardanelle, Ark	256	21	1.8	1	0.4	22-30	0.9	1.4
Little Rock, Ark	176	23	3.5	1	1.1	27	2.1	2.4
White River.								
Newport, Ark	150	26	0.9	1-3	0.0	30,31	0.4	0.9
Yazoo River.								
Yazoo City, Miss	80	25	0.4	9,10	−1.4	31	−0.6	1.8
Red River.								
Arthur City, Tex	638	27	9.3	29	4.3	20-25	5.1	5.0
Fulton, Ark	515	28	6.8	1	4.3	23,24	5.3	2.5
Shreveport, La	327	29	6.4	1	1.2	31	3.1	5.2
Alexandria, La	118	33	5.0	1	−0.6	29-31	1.8	5.6
Ouachita River.								
Camden, Ark	304	39	3.5	19	3.1	14-17,25-27	3.2	0.4
Monroe, La	122	40	1.7	3	0.0	13-21,24-31	0.5	1.7
Atchafalaya River.								
Melville, La	100	31	21.4	12,13	10.6	31	17.2	10.8
Susquehanna River.								
Wilkesbarre, Pa	183	14	0.0	1-4	−1.4	23-25	0.9	1.4
Harrisburg, Pa	69	17	3.1	1	1.5	26,29-31	2.0	1.6
W. Br. of Susquehanna.								
Williamsport, Pa	39	20	3.1	1	0.7	23-25	1.4	2.4
Juniata River.								
Huntingdon, Pa	90	24	5.0	16	3.0	14,15,25-31	3.5	2.0
Potomac River.								
Harpers Ferry, W. Va.†	172	16	4.0	19	0.0	3-7,11-13	1.4	4.0
James River.								
Lynchburg, Va	260	18	3.8	17	0.7	30,31	2.0	3.1
Richmond, Va	111	12	2.0	18,20	−1.2	6-8	0.3	3.2
Roanoke River.								
Weldon, N. C	129	40	36.0	17	8.8	13,31	13.9	27.2
Cape Fear River.								
Fayetteville, N. C	112	38	41.5	16	3.8	7	14.0	37.7
Edisto River.								
Edisto, S. C	75	6	4.0	1,2	2.7	13-19	3.1	1.3
Pedee River.								
Cheraw, S. C	149	27	25.9	17	3.3	31	9.7	22.6
Black River.								
Kingstree, S. C	60	12	9.2	1	3.7	21	5.8	5.5
Lynch Creek.								
Effingham, S. C	35	12	8.6	24	4.0	9-13	6.0	4.6
Santee River.								
St. Stephens, S. C	50	12	9.5	6	7.3	18-21,31	7.9	2.2
Congaree River.								
Columbia, S. C	37	15	4.2	20	0.5	27	1.7	3.7
Wateree River.								
Camden, S. C	45	24	20.0	10	5.5	31	11.3	14.5
Waccamaw River.								
Conway, S. C	40	7	8.7	29,30	3.7	12	5.5	5.0
Savannah River.								
Calhoun Falls, S. C	347	......	4.0	1	2.7	24,25	3.2	1.3
Augusta, Ga	268	32	12.9	21	7.5	26	9.8	5.4
Broad River.								
Carlton, Ga	30	......	6.3	20	2.4	13,14	3.0	3.9
Flint River.								
Albany, Ga	80	20	4.8	9	0.9	31	2.8	3.9
Chattahoochee River.								
Westpoint, Ga	239	20	6.6	17	2.8	15,27,28	3.7	3.8
Ocmulgee River.								
Macon, Ga	125	20	15.4	20	2.5	15,27	4.0	12.9
Oconee River.								
Dublin, Ga	79	30	7.6	23	1.4	28	3.4	6.2
Coosa River.								
Rome, Ga	271	30	5.5	18	1.6	31	2.6	3.9
Gadsden, Ala	144	18	4.0	20	1.0	30,31	2.1	3.0
Alabama River.								
Montgomery, Ala	265	35	5.5	19	2.0	16	3.9	3.5
Selma, Ala	212	35	7.3	20	1.0	1	4.6	6.3
Tombigbee River.								
Columbus, Miss	308	33	−1.6	1	−3.4	31	−2.7	1.8
Demopolis, Ala	155	35	2.7	24	−1.5	17	0.3	4.2
Black Warrior River.								
Tuscaloosa, Ala	129	43	7.3	21	0.4	17	2.3	6.9
Brazos River.								
Kopperl, Tex	369	21	0.2	1	−0.2	4-31	−0.2	0.4
Waco, Tex	301	22	1.5	1	0.5	10-31	0.7	1.0
Booth, Tex	76	39	1.5	1	0.2	27,28,31	0.7	1.3
Red River of the North.								
Moorhead, Minn	418	......	9.1	9	7.8	24-26	8.3	1.3
Columbia River.								
Umatilla, Oreg	270	25	15.3	1	11.8	31	13.6	3.5
The Dalles, Oreg	166	40	25.5	1	18.2	31	21.5	7.3
Willamette River.								
Albany, Oreg	119	20	1.9	1-8	1.3	26-31	1.6	0.6
Portland, Oreg	12	15	13.5	1	9.2	28-30	11.1	4.3
Sacramento River.								
Red Bluff, Cal	265	23	0.5	1-4	−0.1	31	0.2	0.6
Sacramento, Cal	64	29	12.3	1	8.5	31	10.1	3.8

*Twenty-two days only.

†Twenty-three days only.

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Chart I. Tracks of Centers of High Areas. July, 1901.

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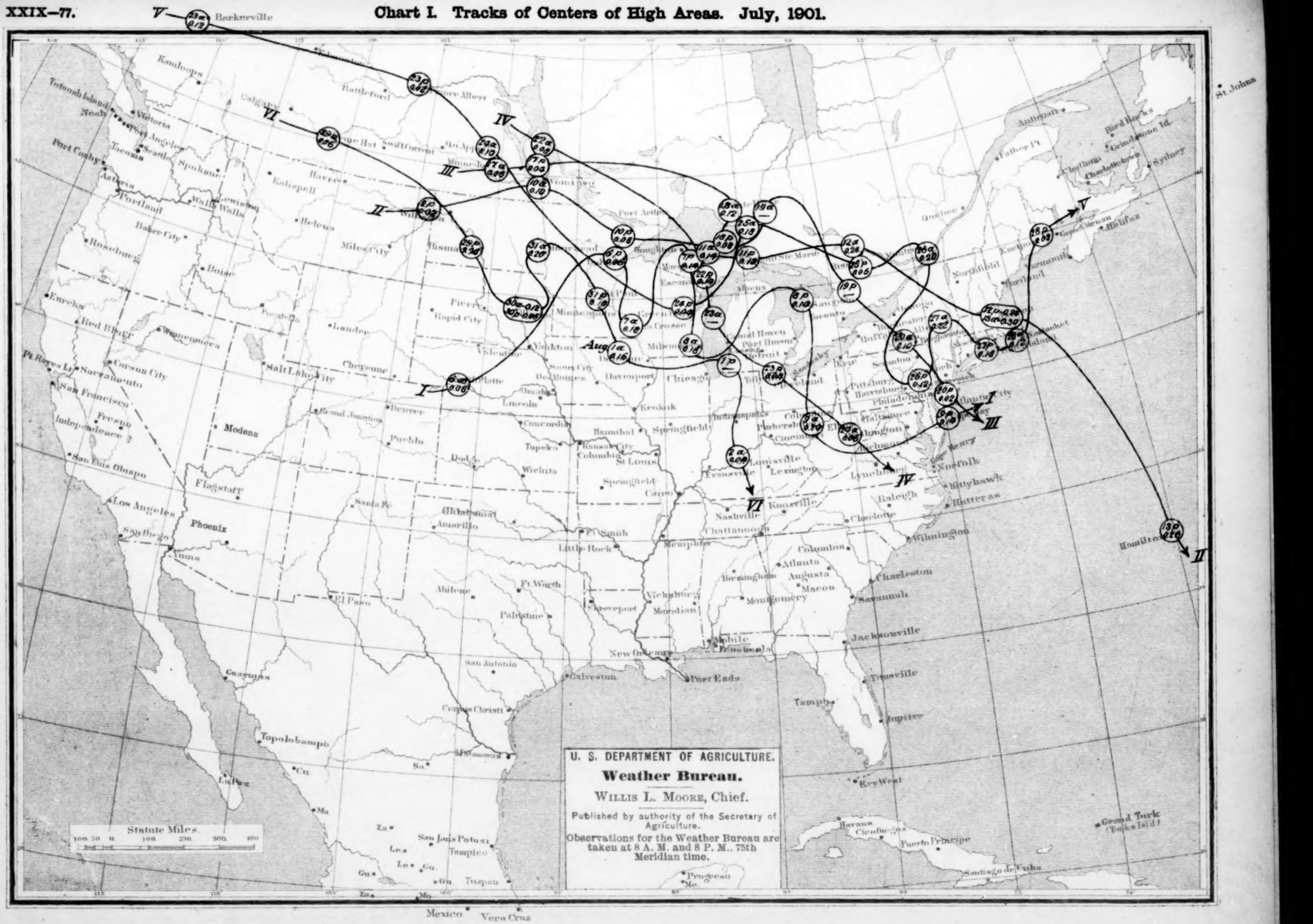


Chart II. Tracks of Centers of Low Areas. July, 1901.

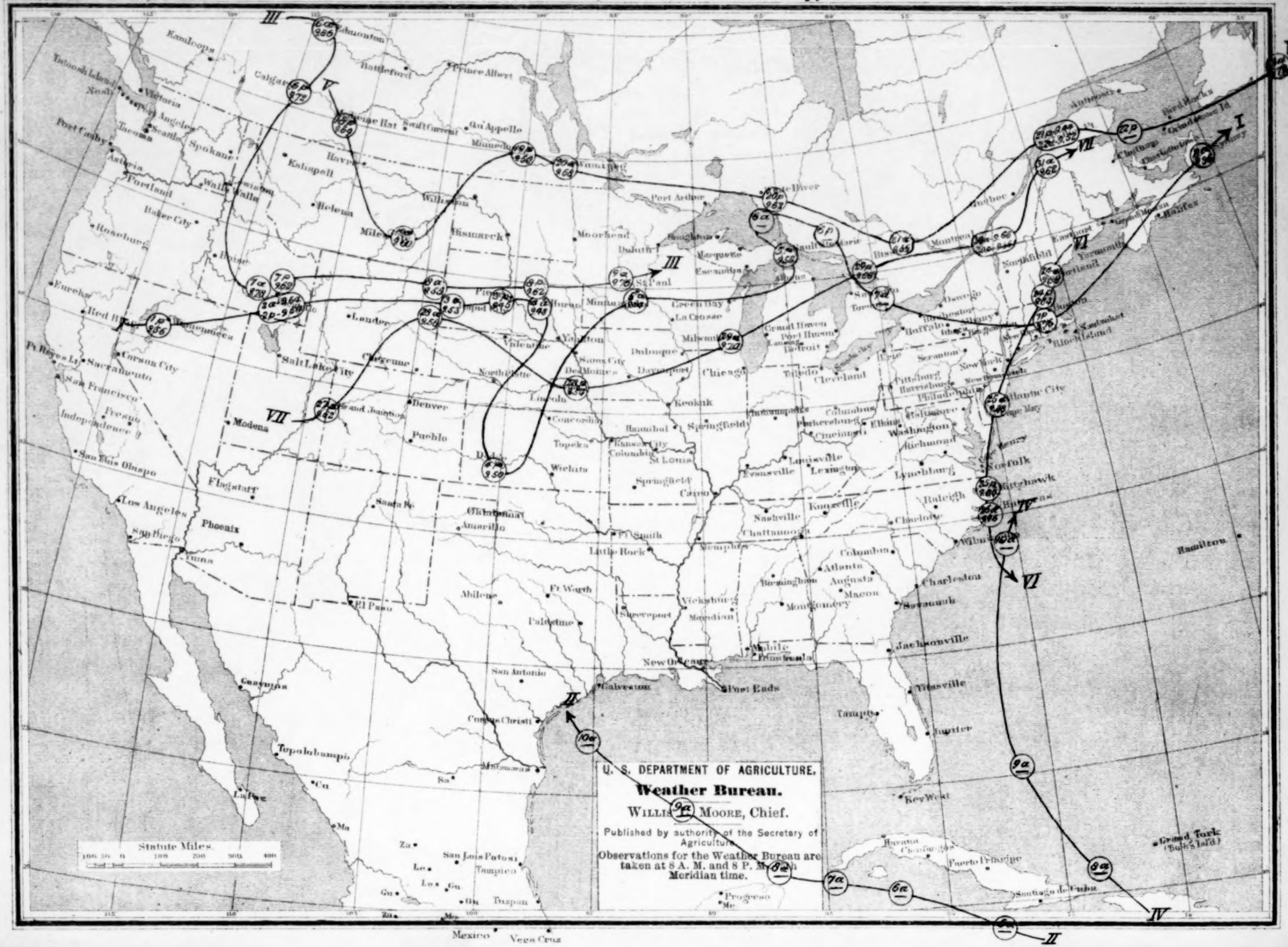


Chart III. Total Precipitation. July, 1901.

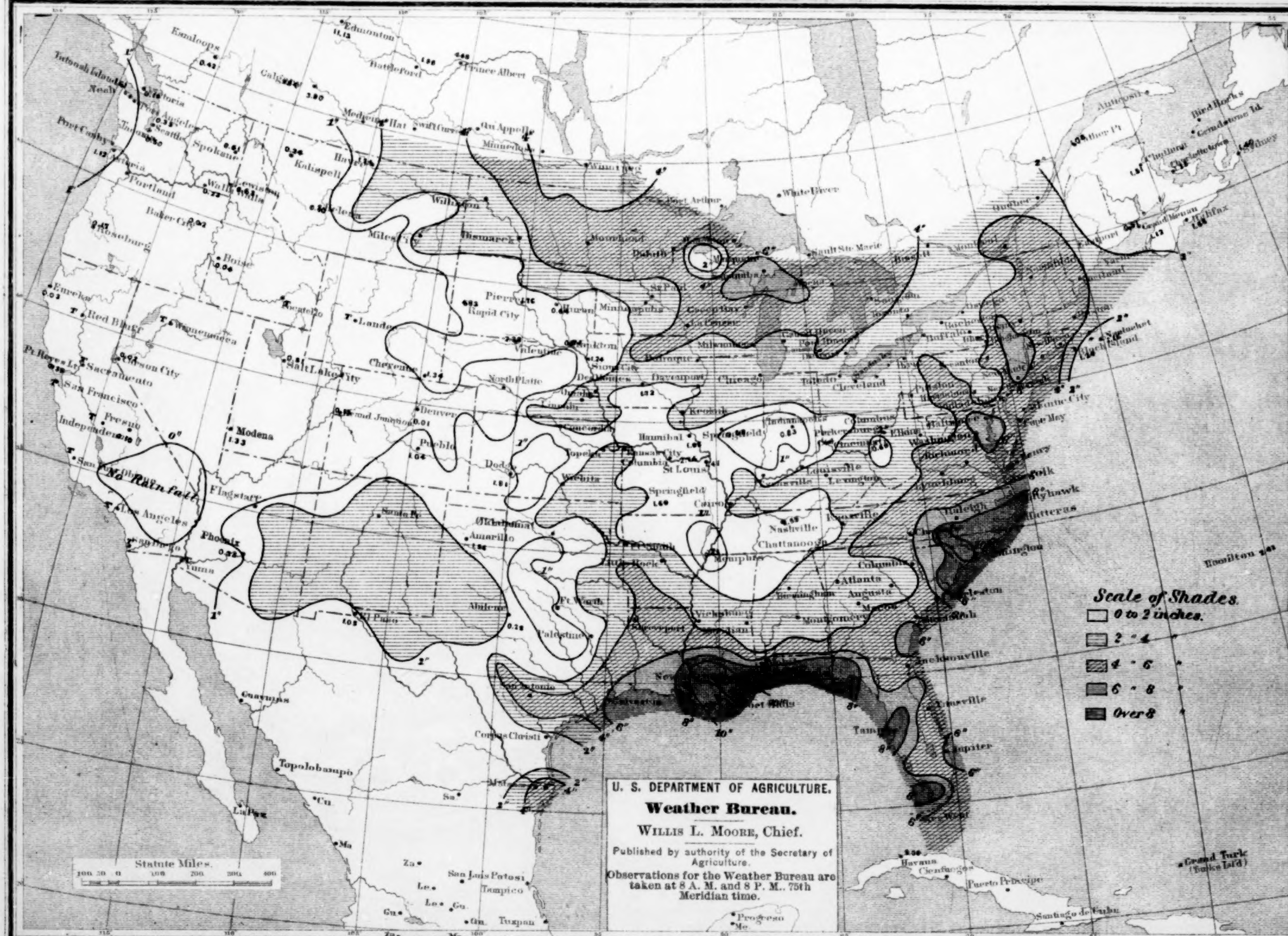


Chart IV. Sea-Level Pressure and Temperature; Resultant Surface Winds. July, 1901.

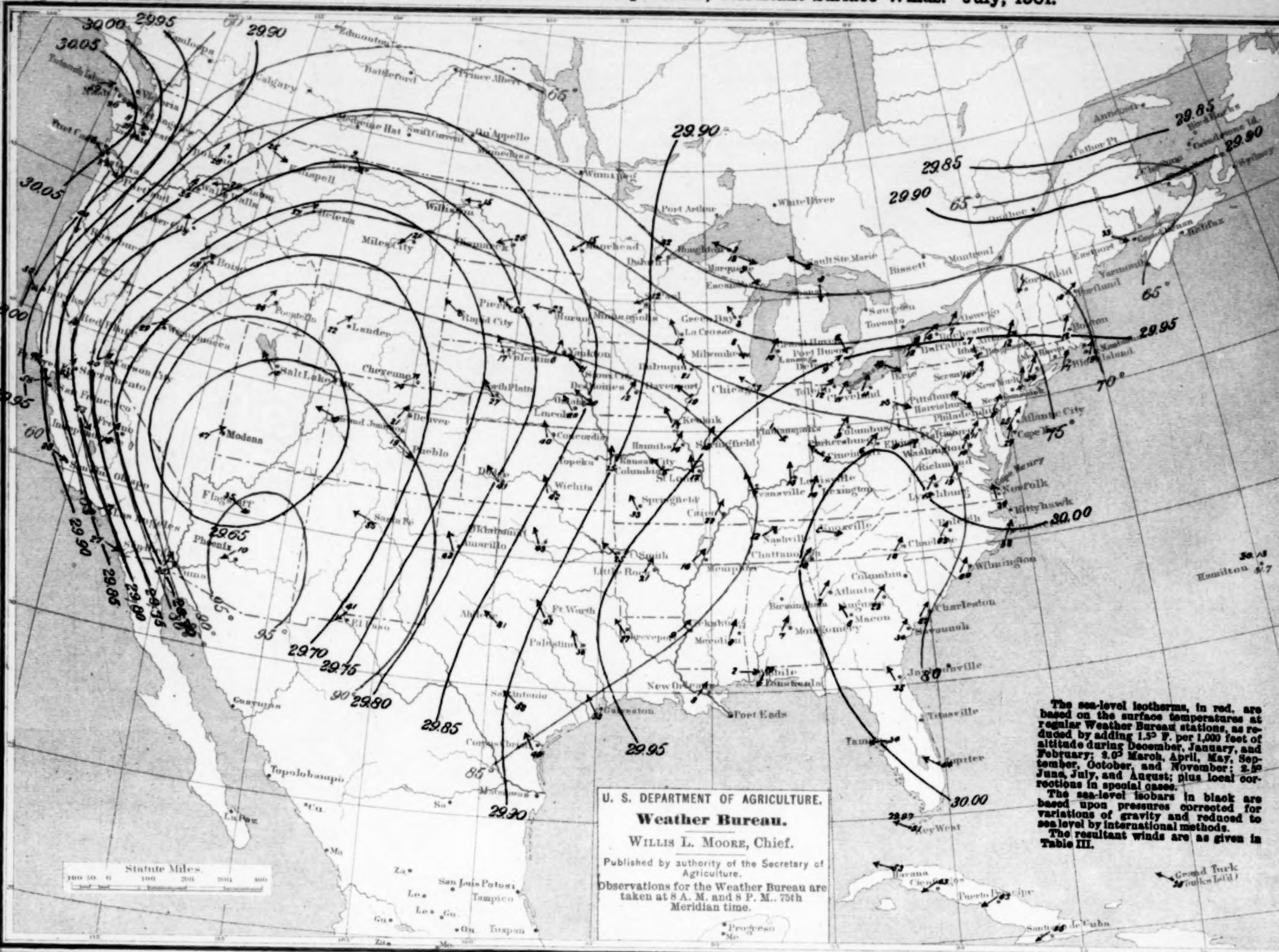


Chart V. Hydrographs for Seven Principal Rivers of the United States. July, 1901.

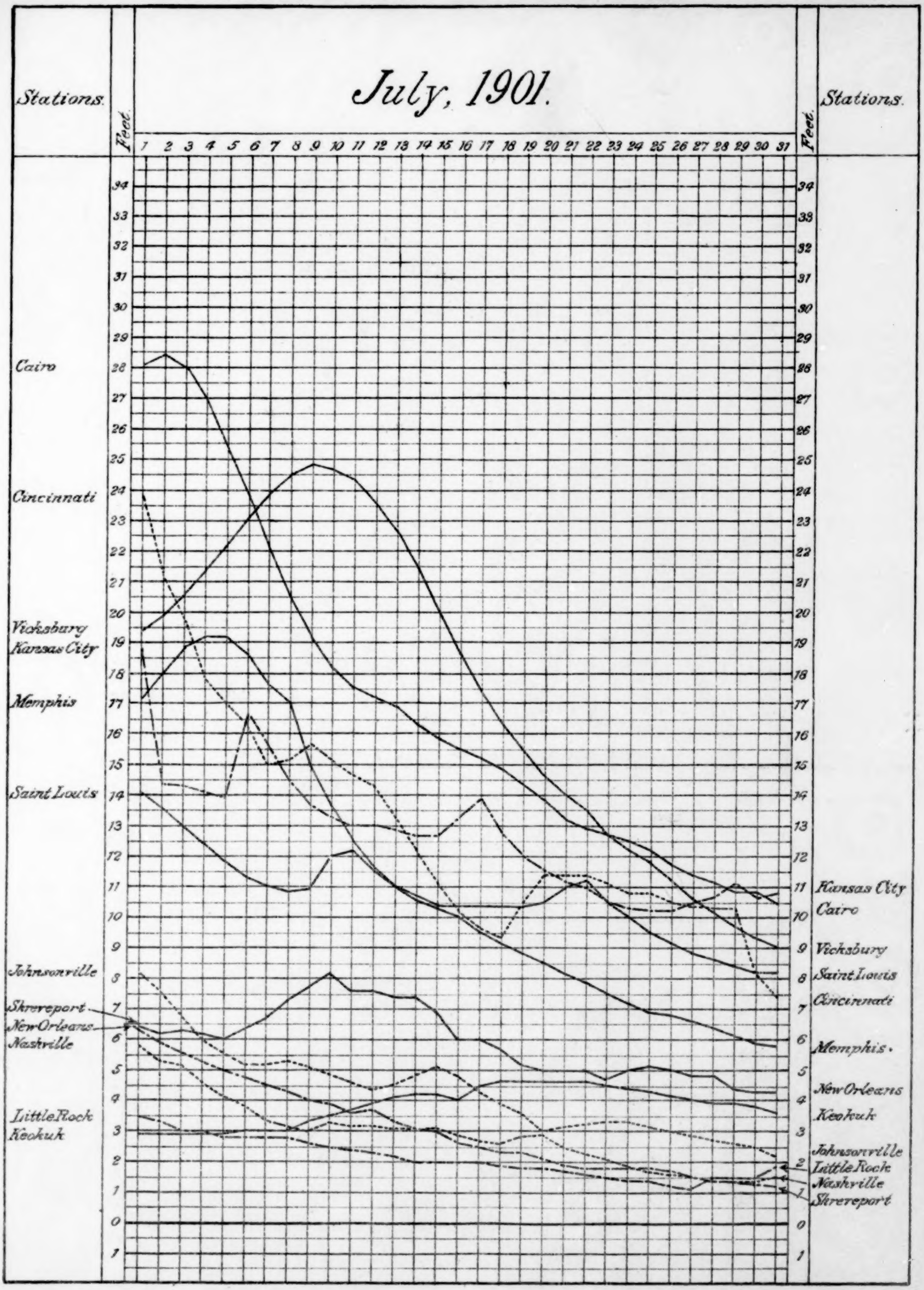


Chart VI. Surface Temperatures; Minimum and Mean. July, 1901.

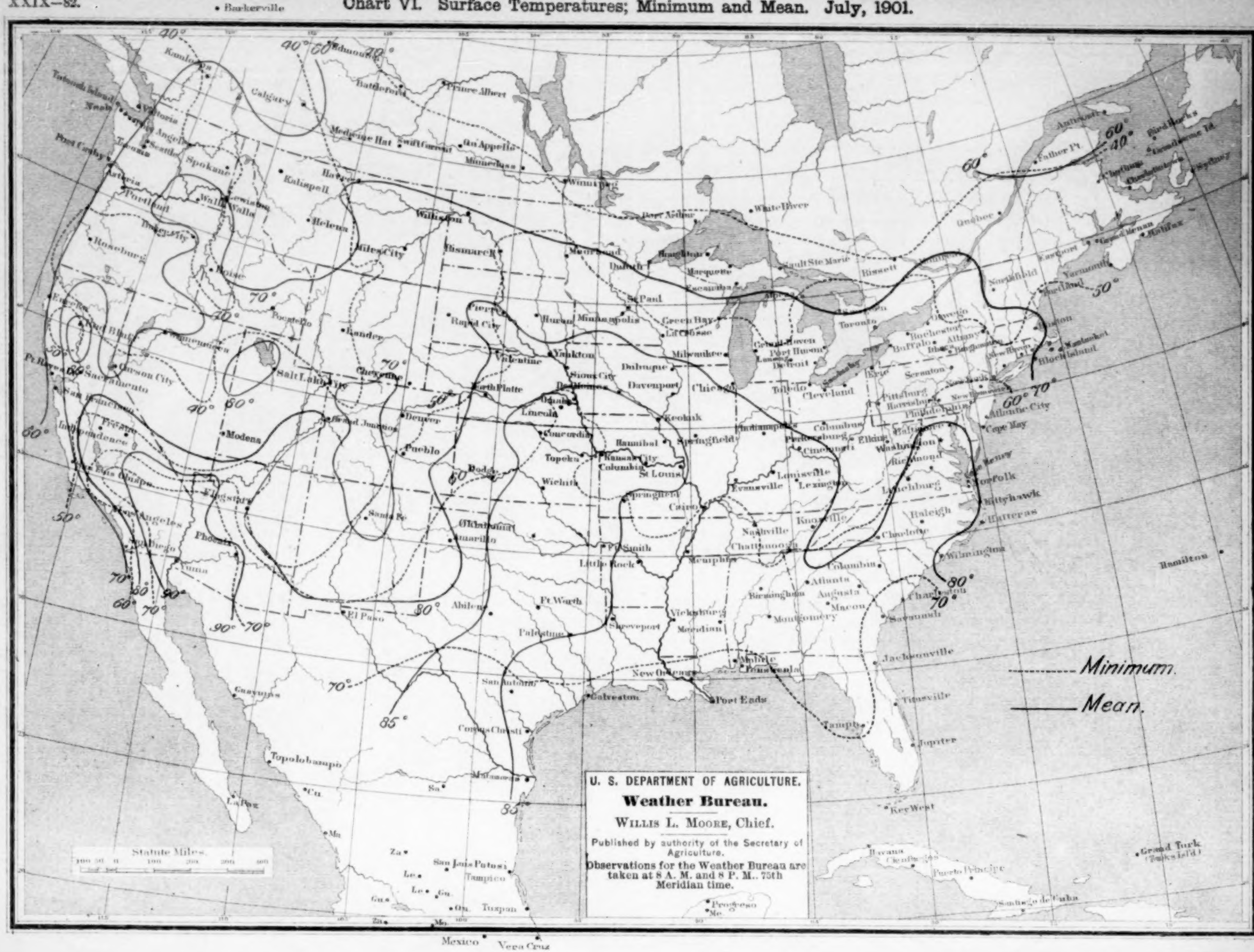


Chart VII. Percentage of Sunshine. July, 1901.

Chart VII. Percentage of Sunshine. July, 1901.

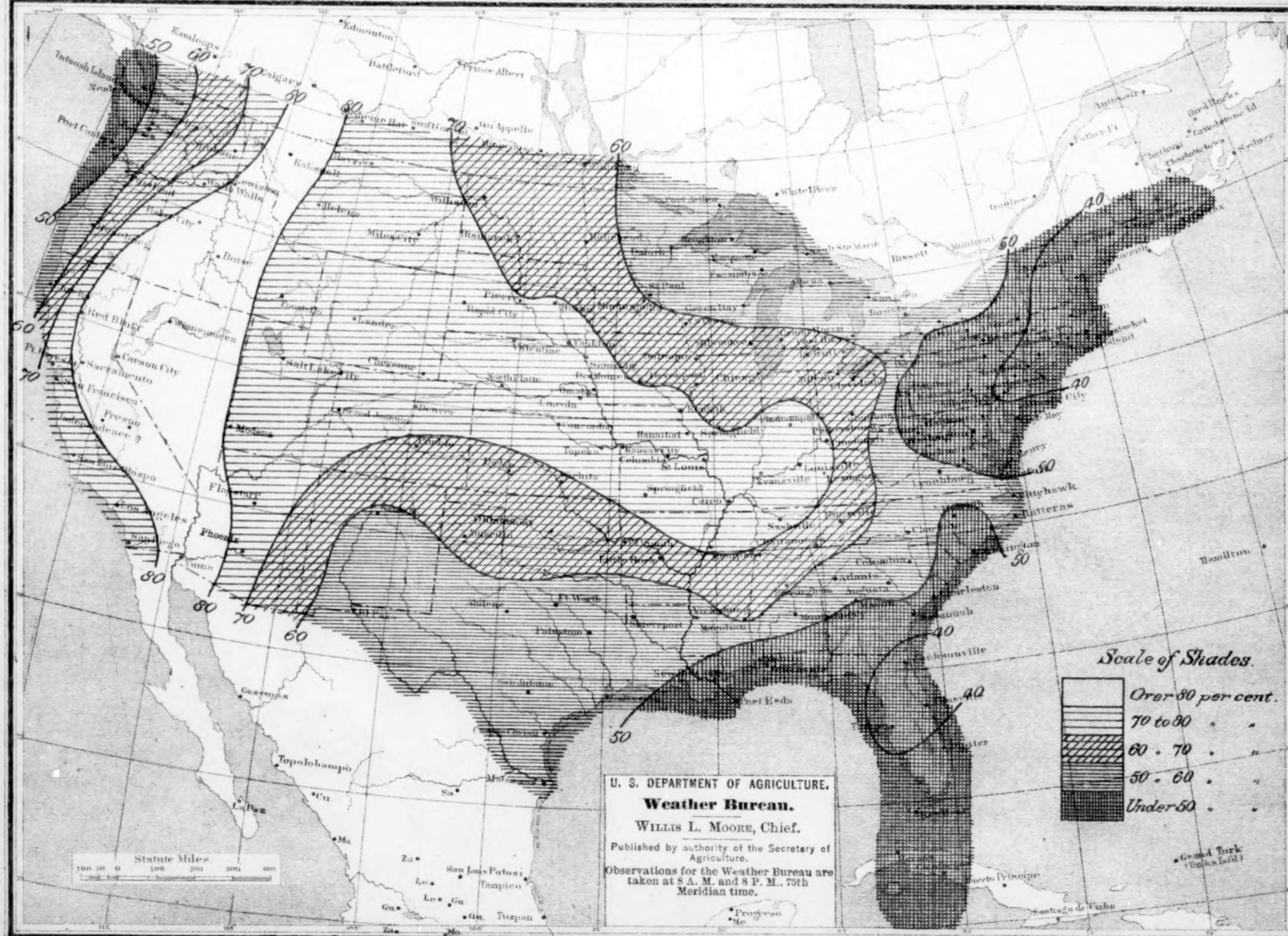
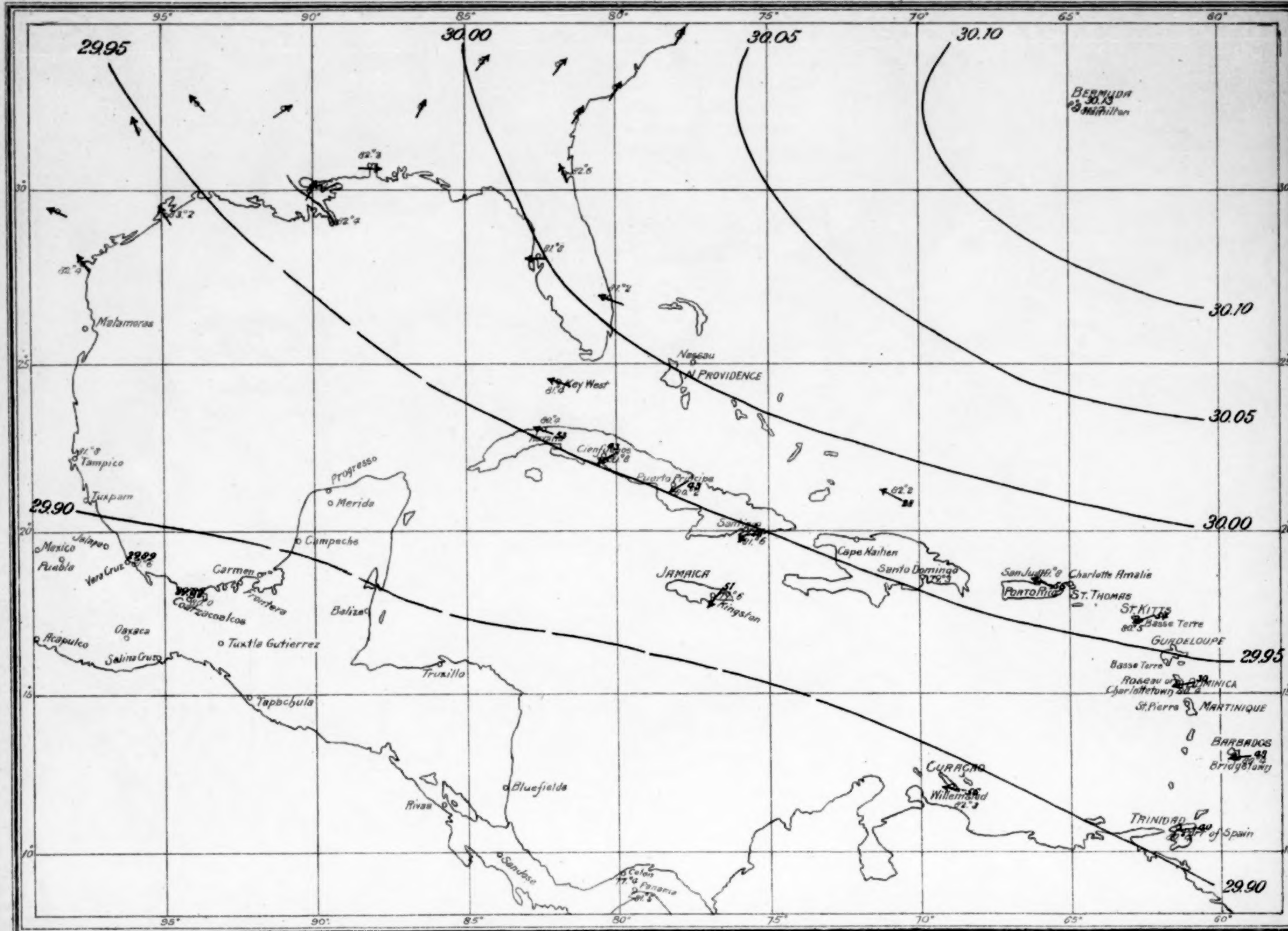


Chart VIII. West Indian Monthly Isobars, Isotherms, and Resultant Winds. July, 1901.



 • Barkerville Chart IX. Maximum Surface Temperatures. July, 1901.

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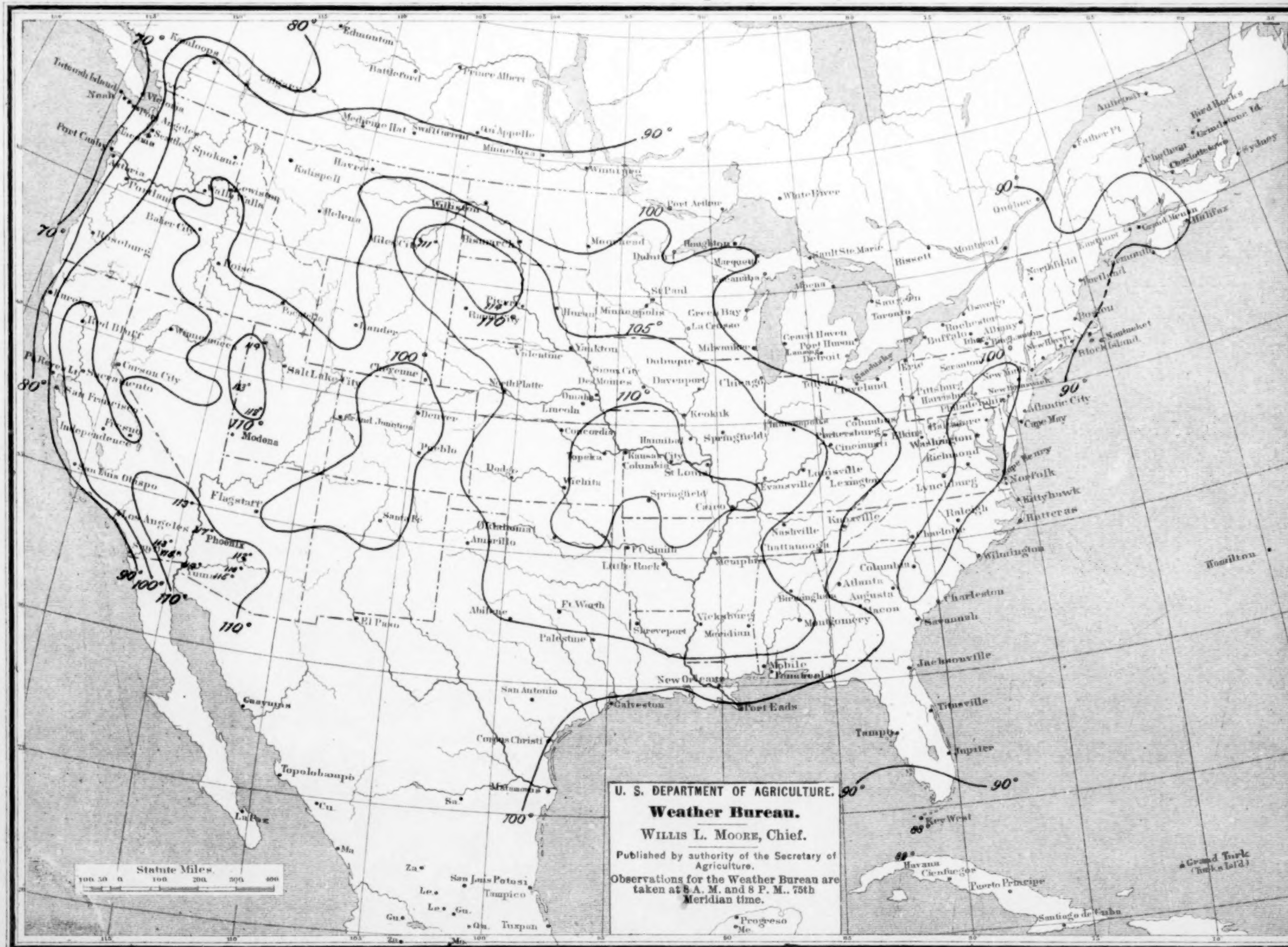
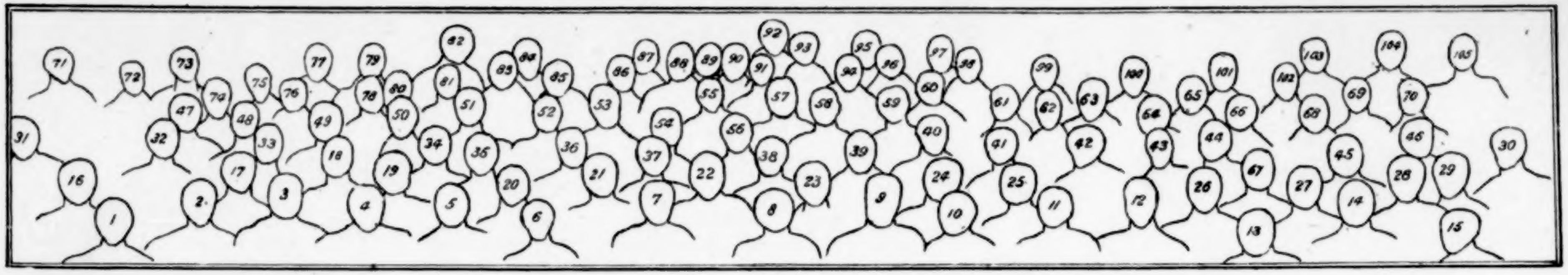
Chart IX. Maximum Surface Temperatures. July, 1901.



Key to Plate I, Monthly Weather Review, July, 1901.



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5 Mr. L. M. Pindell, Chattanooga.
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99 Mr. G. E. Franklin, Los Angeles.
100 Mr. F. W. Conrad, Green Bay.
101 Mr. J. Warren Smith, Columbus.
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103 Mr. W. M. Dudley, Mobile.
104 Mr. S. M. Blandford, Boise.
105 Mr. A. J. Mitchell, Jacksonville.

*Visitors to the Convention.

The Weather Bureau Officials at Milwaukee, Wis., August 29, 1901.